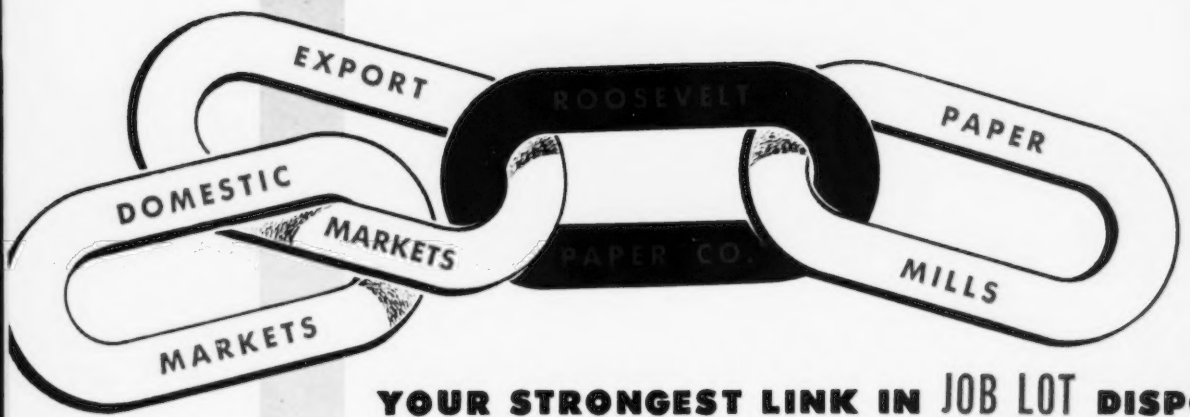
PAPER TRADE JOURNAL

February 27, 1953



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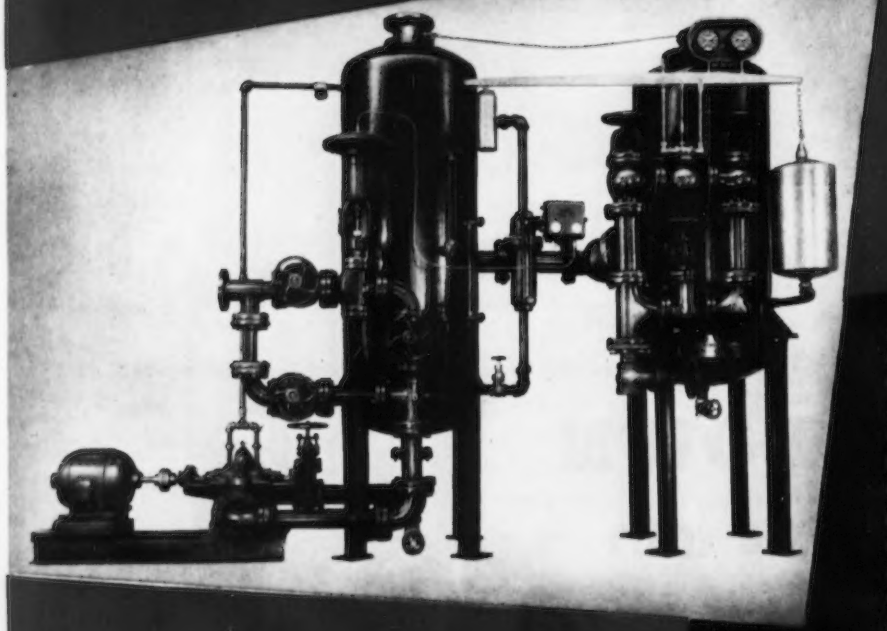
GULF INDUSTRIAL LUBRICATION

an eye opener...



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- Would you like to dry faster and increase your tonnage?

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SUBSCRIPTIONS

U. S. $5.00 per year to pulp and paper mill personnel, others $7.50. U. S. Possessions and Canada $7.00. Latin American Countries $15.00, all others $20.00. Single copies are 25c.

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REMEMBER THESE DATES

MARCH 16, 17, 18: National Paper Trade Assn., Annual Meeting, Waldorf-Astoria Hotel, New York, N.Y.

APRIL 14-15: Fibrebox Assn., Spring Meeting, Edgewater Beach Hotel, Chicago, Ill.

APRIL 18-19: Packaging Machinery Manufacturers Institute, Semi-Annual Meeting, Sheraton Hotel, Chicago, Ill.

APRIL 26-29: American Institute of Chemical Engineers, Joint Meeting with Chemical Institute of Canada, Royal York Hotel, Toronto, Canada.

MAY 18, 19, 20: National Paperboard Assn., Spring Meeting, Santa Barbara Biltmore Hotel, Santa Barbara, Calif.

JUNE 4-6: Technical Section, C.P.P.A., Saranac Inn, Saranac, N.Y.

JUNE 9-11: American Pulp and Paper Mill Supts. Assn., National Meeting, Atlanta-Biltmore Hotel, Atlanta, Ga.

PAPER TRADE JOURNAL

FEBRUARY 27, 1953, *Vol. 136, No. 9*

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THIS WEEK—*We present an important series of papers on important problems, i.e., mill waste recovery and stream pollution. These papers were presented at the 1953 annual meeting of the national council for Stream Improvement of the Pulp, Paper and Paper Board Industries held during Paper Week February 16-19.*

LOCKWOOD TRADE JOURNAL CO., INC., 15 W. Forty-Seventh St., N.Y. 36

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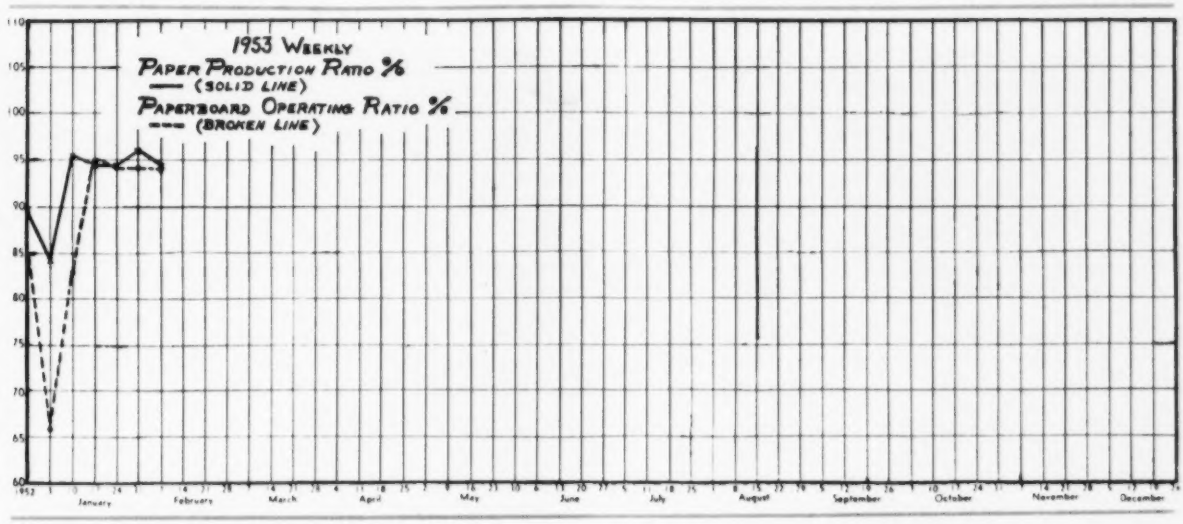
OUR BUSINESS



Brief of Important Figures

Source	Production	WEEK ENDING Feb. 14, '53	Jan. 17, '53	Feb. 16, '52
APPA	Paper Production Percent Capacity[3]	95.9	94.7	97.9
	Unbl. Kraft Paper Production Percent	N.A.	N.A.	94.7
NPA	Paperboard Operating Ratio Percent Inch Hours	95	95	87
		Dec. 1952	**Nov. 1952x**	**Dec. 1951**
APPA	Paper Production* (Except Newsprint and Building Papers) ....Tons	808,000	799,466	837,000
	New Orders ....Tons	821,000	758,480	807,000
	Unfilled Orders ....Tons	781,785	776,929	884,500
	Shipments ....Tons	799,000	799,107	836,000
		Dec. 1952	**Nov. 1952**	**Dec. 1951**
NPA	Paperboard Production ....Tons	1,029,091	964,046	757,914
	New Orders ....Tons	1,077,602	982,785	768,320
	Unfilled Orders ....Tons	478,354	475,365	358,720
	Our Customers Activities Index[1]	**Latest Mo.°**	**Previous Mo.°**	**Year Ago°**
FRS	Manufacturers Total Index	245	245	229
	Durable Mfg. Index	301	300	227
	Nondurable Mfg. Index	200	200	191
	Chemical Products Index	312	309	304
	Mfg. Food Products Index	166	178	164
	Printing and Publishing Index	184	180	183
ODC	Magazine Advg.-Printer's Ink Index	408	420	347
	Prices Index			
BLS	Consumers Price Index[1]	191.1	190.9	188.6
	Wholesale all Commodities[4]	110.7	111.1	113.6
	Wholesale Processed Foods	107.7	108.5	111.0
	Commodities other than Farm Products and Foods[4]	112.8	113.0	114.5
	Wholesale Pulp, Paper[4] and Allied Products	115.5	115.5	118.4
	Purchasing Power of Dollar, Consumers Prices[1]	52.3	52.4	53.0
	General Activity Index			
FRS	Mfg. Production-Worker Payroll[4]	143.9	143.8	129.8
	Unemployment Compensation Initial Claims (M)	690	679	948
	Miscellaneous Carloadings–Thousands of Cars	1,938	1,673	1,524
	Electric Output (Million KW hr.)	39,351	40,511	37,321
PTJ	Average 32 P & P Common Stocks as of Feb. 21	$36.20	$36.65	$35.48

[1] 1935–39 = 100 Unadjusted Index.
[3] New 6-7 day basis.
[4] New Index 1947–1949 = 100.
* For details see APPA Monthly Statistical Summary—December 1952 Estimated Figures.
° Latest Month Available on Request.
x Revised Figures. N.A.: Not available.

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PAPER TRADE
JOURNAL
TRENDS

High Optimism Permeated Convention

Spotty depression noted . . . .

High optimism permeated the Annual Convention of the APPA held at the Waldorf-Astoria last week. There were however spots of depression, particularly notable among the industry's suppliers.

Heading the parade for the optimists was the Association's executive secretary, E. W. Tinker, who told the first press conference he expects the industry's 1953 output will approximate 1951's; that new capacity during the year will amount to over 1,000,000 tons.

Sydney Ferguson, chairman of Mead Corp., Dayton, Ohio, and president of APPA, and Dr. Louis T. Stevenson, industry economist, held to the belief that 1953 will be a good year, order backlogs rising slowly, and that the trend of business for paper and boards will follow that of general business in both nondurables and durables which look healthy.

Others interviewed in Convention corridors spoke hopefully of their own Company operations. Business for them is good, most said, and getting better. Order backlogs aren't huge; customers are shopping for best price and prompt delivery, along with quality of product; but they are operating at close to full operations now, don't want to return to the abnormal pressures of 1951.

Indicated by the customer demand for rush deliveries is a low stock level. Thus any slight pressure at the consumer end could easily stiffen the market, it is said.

Exceptions also are evident . . .

Exceptions to these conditions are present in all segments of the industry. Competition is keen and pressure being exerted on publication papers, industrials, boards, etc., in fact the situation is pretty spotty.

It is not however reported for machine coateds and certain top enamels, most of which returned to customer allocations some months back. Other producers are striving to avoid the psychosis which an allocations system always builds up.

Market conditions in paperboards, the industry's bellwether, are giving some concern. Backlogs are not large and pressure of demand has eased to a more steady flow.

Competition in plain chip however has spread to filled news and like grades. In this area, some large mills are booking steadily at $80 for plain chip, while others have a price of $70 or $75. Pressure from marginal mills is notable on this grade.

Filled news at $82.50 is reflecting the pressure, and quotations below this level are spoken of and sales reported. Other grades appear to be mainly undisturbed.

A steady flow is a good normal . .

It is a steady flow of business rather than peaks for which the industry hopes this year. If there be a norm of supply-demand, of steady production (which used to be rated about 80-85%) of progressive selling and merchandising, they hope it will set in during 1953.

This is the keynote of the industry's optimism. It is prepared to do such a peacetime job and can be alerted to an international emergency.

Price levels further discussed . . .

Pricewise, there seemed to be none who was willing and able to say paper prices would not advance.

In some cases, men held that prices could return to the OPS ceiling levels from which some papers dropped during late 1952.

What is ahead depends on the volume of conusmer demand. But prices should rise moderately in view of increased costs, is the widely-held opinion of industry spokesmen.

Pessimism Grips Waste Paper Dealers

Pessimism like a heavy fog hangs over the waste paper market. One talks with established dealers and finds himself almost engulfed by the mental depression, then shakes free and asks why.

The pessimism isn't fancied; it isn't regional. Many of the dealers are sunk in it. In fact, that's it! They're convincing themselves that they are sunk.

During the writer's trip to the midwest in late January, the depression was found to be so thick that a report was deliberately deferred for more perspective. And though late reports tell of an improvement in the Chicago market, it is not yet of sufficient size to lift market sogginess and dealer grogginess.

How account for it? . . . . .

Asked how they account for it, men come up with several answers, some of which are real; others are rumors told over and over again at luncheon cocktails without any honest attempt to track them down.

Take, for instance, the one that there can be no demand for soft white shavings when pulp (unbleached sulfite) can be bought at $80. We spent some hours running down that one. There was one rejected lot of a good pulp that because of coal dust and other damage was being offered for quick disposal by a salvage company. Beyond this, pulp and mill men know of no such ridiculous figure for any grade of pulp.

True, market demand for quality papers means that mills are using more pulp than in 1951, particularly true because the price also is right. True also is that other mills prefer to continue to use a percentage of shavings. Emphasized by this group, however, is that they can now insist on quality of packing and will.

Which leads to the question passed along to the Waste Paper Utilization Council: Why build a program for more waste paper use when dealers are "crying in their beer" about the current flooded market.

The core of Director Henry J. Perry's answer was that the Council has a two-fold program: the long range is for greater utilization of secondary fibers—pulp substitute grades of waste paper; the near, to educate mills and packers with the importance of quality and reliable pack, grade by grade.

Emphasized repeatedly is the need for adamant rejections of the sub-quality and weighted packs which are on record at domestic mills and a source of law suits in the export market.

For the dealers, it boils down to this conclusion: see to it that the packing meets specifications and the net result will bring a market balance with mill needs.

A final gripe comes from the fact that more stock is flowing from producing mill to consumer and bypassing the dealer. True! The mill became sold on such a deal when it needed pulp and could not rely on waste paper. By purchasing cuts of a known and dependable grade, they are provided with a reliable furnish at a stable price, they say.

The waste paper industry appears to be taking a sort of sulphur-and-molasses tonic: not too unpleasant if one has a strong stomach; and guaranteed ultimately to cleanse the blood of stored-up impurities, they used to say. *Ultimately* is accented for one needs both patience and, in this case, faith that he will survive by putting his house in order with an early spring housecleaning.

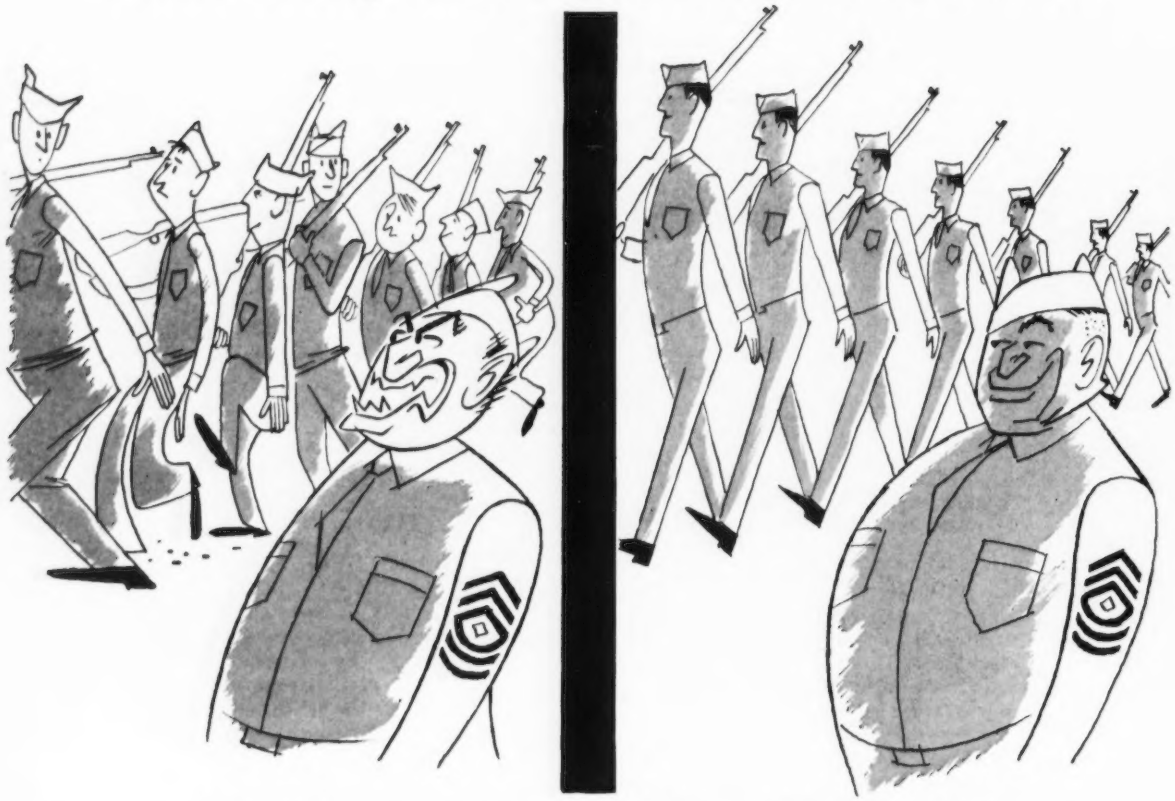
—E.P.N.

Paperboard Production (Tons)*

	Feb. 14 1953	Feb. 7 1953	Feb. 16 1952
Production	245,665	238,012	214,477
New Orders	217,420	331,971	170,485
Unfilled Orders	514,273	545,961	396,837
% of Activity	95	94	87

* Source: National Paperboard Assn.

Uniformity makes the difference . . .



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WEEK OF PAPER TRADE JOURNAL FEBRUARY 27, 1953

St. Helen's and Crown Zellerbach Merger Confirmed

PORTLAND, Ore. — Report of a proposed eleven million dollar merger of Crown Zellerbach Corp. with St. Helens Pulp and Paper Co. was confirmed by Harry T. Nicolai, chairman of the board of the St. Helens company. The plan was approved by Crown Zellerbach directors in San Francisco February 19, and had already been approved by St. Helens company board, Nicolai said. Closing of the deal now awaits only routine legal steps, it is understood, and depositing of 80 percent of St. Helens stock by that corporation's stockholders. Merger agreement is understood to call for exchange of one share (prior to the two-for-one split) of authorized but unissued common stock of Crown Zellerbach for two and one-third shares of outstanding St. Helens stock. The St. Helens company plant has reached the six million dollar mark in a current nine million dollar remodeling and expansion program to increase its capacity from 55,000 to 90,000 tons of pulp a year.

Stone Container Buys Artkraft Paper Products Co.

Stone Container Corp. has purchased the corrugated box plant of Artkraft Paper Products Corp., Pittsburgh. Located almost mid-way between the firm's container divisions in Philadelphia and Mansfield, Ohio, the new plant is Stone Container's fourth container division.

There are no changes planned at present in the Pittsburgh plant's personnel. The plant's purchase price was not revealed.

Union Bag Plant For St. Louis Rumored

Unofficial reports state that Union Bag & Paper Corp. plans to erect a multi-wall bag plant in St. Louis, Mo.

Site for the new plant has already been acquired on the Frisco Lines.

Union Bag's multi-wall operations are now centered at Savannah. It is to be expected that some of the supervisory personnel there will be shifted to St. Louis to get the new plant in operation later this year.

The St. Louis plant will get its paper by rail from Savannah.

F. W. O'Neil

O'Neil Succeeds Libby

Prof. Frederic W. O'Neil has been promoted to head of the department of pulp and paper technology at the State University College of Forestry.

The appointment is effective March 1. Prof. O'Neil replaces C. Earl Libby, who retired last July after 32 years' service at the college. He is also director of a hardwood pulping research project jointly sponsored by the College and Empire State Paper Research Association, Inc.

Consolidated's Coating Appeal Due For Spring Hearing

The appeal filed by the Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis., in the so-called Paper Coating suit against Kimberly-Clark Corp., of Neenah, Wis., is scheduled for Spring hearing in the Chicago Circuit Court of Appeals.

Estimated to be in the *million-dollar class*, the suit was dismissed by Federal Judge Robert E. Tehan in Milwaukee last Fall. It charged Kimberly-Clark Corp. with patent infringement during 1940 to 1950, when the patent expired.

Appeal was immediately filed by Consolidated in the Chicago Court of Appeals. Consolidated hopes for a reversal of the decision that Kimberly-Clark did not infringe on the patent and that the patent was invalid.

Barrett Co. Buys Louiseville

Louiseville Pulp and Wallboard Manufacturing Ltd., who operate a small wallboard mill at Louiseville, Que., has been sold to Barrett Co., Ltd., of New York.

Repeal Canadian Sales Tax

Canadian Government has repealed the sales tax on books and materials used for production of books, magazines and newspapers. This includes the sales tax on newsprint and other materials used in newspapers.

Despite the removal of the $10 sales tax, newsprint manufacturers will increase their prices $10 a ton to Canadian publishers effective April 1. This price increase has been confirmed by Premier Maurice Duplessis of Quebec.

Prairie State Completes Waterproof Division

Prairie State Paper Mills, 122 South Michigan Avenue, Chicago 3, Ill., have completed construction of a 60,000 square foot addition to their Joliet, Ill., plant, to house their new Waterproof Paper Division. Construction of an ultra-modern waterproof paper laminating machine has been completed. Herman J. Finder, president of Prairie State Paper Mills, advises that H. E. (Hal) Baumrucker has joined the organization as sales manager of this new division. Hal has been identified with the waterproof paper industry for the past thirty years. Production on all grades of duplex asphalt laminated, reinforced, building and special combination papers will begin early in March.

Shelton Plant of Rayonier Resumes Operations

The Shelton, Wash., plant of Rayonier, Inc., resumed operations February 16 after a shutdown since January 18 due to a slump in the demand for chemical cellulose.

For a week all four Rayonier plants in the state were scheduled to operate 24 hours daily. On February 22, however, the Port Angeles mill was scheduled to close for about three weeks.

Keith Paper Co. Sold

Keith Paper Co., Turners Falls, Mass., has been sold to a new company composed of the following: Aaron Krock, president; James Sweet, vice-president; William Roberts, treasurer; and Herbert Gold, assistant treasurer.

The mill makes fine writing paper. Plans are being formed to increase onion skin production.

Professor Libby Honored at Joint Alumni Luncheon

On February 18 of Paper Week, over 300 graduates of two institutions gathered at noon in Hendrick Hudson Room of the Roosevelt Hotel, New York City, to honor Professor C. E. Libby for his long service in the education of pulp and paper engineers. It was appropriate that he be feted by graduates of both the University of Maine and the New York State College of Forestry inasmuch as he was himself a graduate of the former institution and past head of the pulp and paper department of the latter college.

Professor Libby (R.), receives NYSCF Alumni Gifts from William R. Willets (L.), Titanium Pigment Co.

Professor Libby, who is currently head of the department of papermaking in the School of Forestry, North Carolina State College of Agriculture and Engineering, received two presentations. Members of the University of Maine Pulp and Paper Foundation conferred on him their annual "honor award" which read as follows:

"Presented to Clarence E. Libby, loyal son of Maine, in recognition of many years of fruitful teaching and research in pulp and paper. Those whom he has inspired will long carry on the principles which he has taught and the ideals which he has implanted."

Following delivery of this citation, William Willets of Titanium Pigment Co., representing the NYSCF presented Professor Libby with a bound book of the autographs of his former students at Syracuse, also a rare, four-volume history of "The Handmade Papers of Japan," and in addition, a blank travel order, good at any time for over $500 of travel expenses.

Maine alumni were welcomed to the luncheon by Harsden Hutchins, of Johns-Manville Company, chairman of the U. of M. pulp and paper alumni group. A similar welcome was extended to alumni of the New York State College of Forestry by Clark Snook, of Nopco Chemical Company, vice-chairman of the NYSCF alumni.

Presentation of University of Maine Pulp & Paper Foundation "Honor Award' Is Made to Professor Libby by J. L. Ober (L.), Scott Paper Co.

Members of the New York State College of Forestry's class of 1928 (25-year class) were presented by Lewellyn B. Tucker, technical director, Crane and Company, a member of the class. Members of this group who were present were D. A. Hunter, resident manager, Diamond Match Company, Ogdensburg, N. Y.; C. L. Van Schaick, executive vice-president, Dixie Cup Company, Easton, Pa.; and Vernon Woodside, district sales manager, Mathieson Chemical Corporation, New Orleans, La.

Everett Mansfield, president of the Ellis Paperboard Products Company, Portland, a classmate of Professor Libby at the University of Maine, introduced the educator, who told of some of his teaching experiences and developments in the pulp and paper industry.

The U. of M. Pulp and Paper Foundation's "honor award" was presented to Professor Libby by J. Larcom Ober, vice-president of the Scott Paper Company, Chester, Pa., who is chairman of the Foundation. The gift for Professor Libby from the New York State College of Forestry was presented by William R. Willets, of the Titanium Pigment Company.

Announcement was made at the luncheon that the Maine alumni chairman for next year's luncheon will be Fred Herbolzheimer, Jr., technical director, Marinette Paper Company, Marinette, Wis. Serving in a similar capacity for NYSCF will be Clark Snook, of Nopco Chemical Company, and Lewis V. Taylor, Columbia Southern Alkali Corporation, vice-chairman.

Industry Told to Become More Merchandising Minded

The paper industry must keep pace with a shoppers' and retailers' revolution and become more merchandising minded or else its future "may not be too bright," Emanuel Katz, president of Doeskin Products, Inc., manufacturer in the facial tissue and paper dinner napkin industry, told a management seminar for executives in paper distribution at the University of Chicago.

"The entire paper industry has tended to pay more attention to its factory and production problems than to its sales and merchandising problems. Untold millions have been and are being poured into plant expenses while too little is going into sales. I think this is one reason why the paper merchant has been rather short on modern sales promotion and merchandising techniques. Now there is every reason to believe that paper merchants have no other choice than to become merchandising experts. Until they do, their future may not be too bright."

Gorman Represents Union Bag

Union Bag and Paper Corp. has appointed Gorman Bentley as sales representative for the company's Standard Products Division. Mr. Bentley will headquarter in the Minneapolis office and will cover the states of Minnesota and Wisconsin. Before joining the Union organization, Mr. Bentley served for two years as manager of the St. Cloud Paper Co., St. Cloud, Minn.

A.P.W.

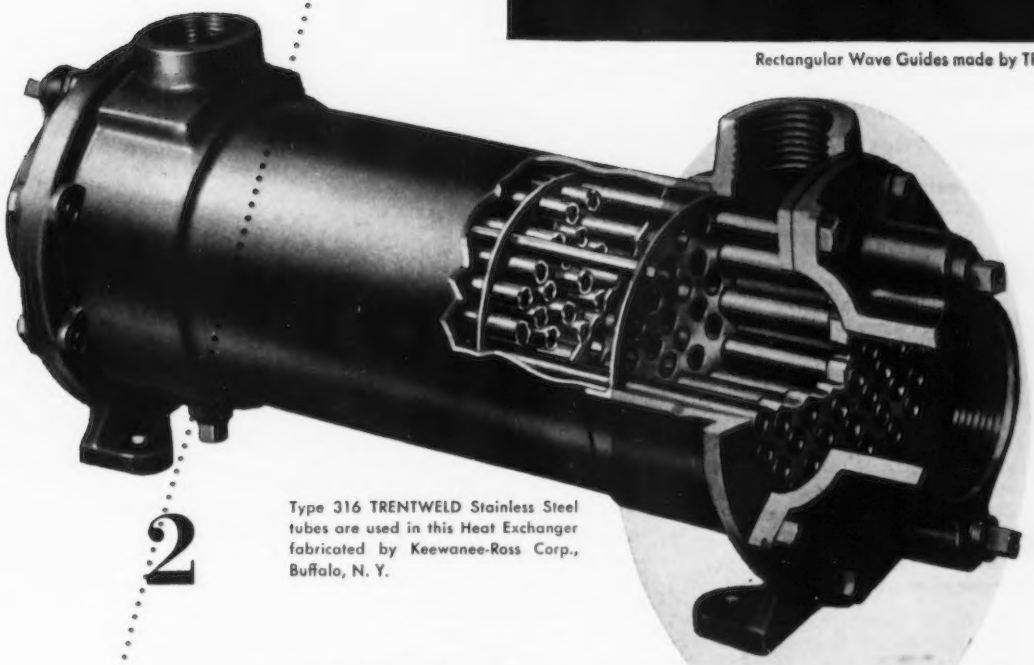
ONLIWON

INDUSTRIAL
TOWELS
TISSUE

1

Rectangular Wave Guides made by TRENTWELD

2



Type 316 TRENTWELD Stainless Steel tubes are used in this Heat Exchanger fabricated by Keewanee-Ross Corp., Buffalo, N. Y.

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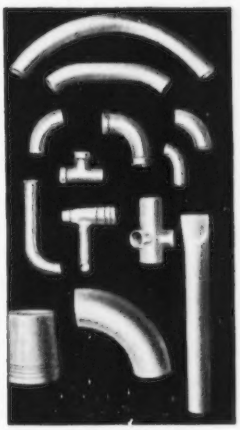

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Problems Connected With Waste Sulphite Liquor Collection, Evaporation And Burning*

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While waste sulphite liquor is being successfully evaporated and burned in Scandanavia and Europe, there still remains a number of problems which must be satisfactorily solved before the operation can be considered even technically successful, aside from the question of economics, on the North American continent. Operating practice here is quite different from European and Scandanavian.

Liquor Concentration

Concentration of liquor recovered is a very important factor in evaporator design and operating costs, irrespective of the volume. Therefore it is necessary to increase concentration in the digester by any means available. It is obvious that good chip packing and the use of indirect heaters with forced circulation is a must. But that is only a start. Dilution necessarily takes place during liquor collections and pulp washing; the greater the percentage of total solids which must be recovered, the greater possible the dilution.

A logical step toward increasing digester liquor concentration is the use of controlled amounts of relief or waste liquor in the cook. Within reasonable limits this has proven satisfactory though the use of waste liquor does tend to increase the SO_2 content of the liquor under operating conditions prevalent on this continent.

Then there is the proposal of impregnating the chips with acid of approximately double the strength of normal, both total and combined, so that the impregnated chips contain sufficient chemical to complete pulping, then withdrawing the bulk of the acid, leaving just sufficient for circulation, and completing the cook. Preliminary to the impregnation, it is good practice to steam the chips thoroughly, driving out all the air possible and making penetration easier. A modification of the procedure, which has been suggested but on which no information is available, is the replacement of the impregnating liquor with waste liquor. This would accomplish two objectives, raise the solids content and provide a more effective method of assuring even heat distribution throughout the digester mass.

As a prerequisite to the above, it would be necessary to locate the collector ring in the lower third of the digester so that circulating liquor would always be available and the pump discharge divided proportionately between the top and the bottom of the digester.

Under optimum conditions a liquor concentration of 20 per cent total solids is not unreasonable. The ability to obtain such an increase in solids content (about ⅓) would be directly reflected in lower investment and operating costs for the evaporator.

Liquor Collection

As the percentage of total solids which must be recovered increases, the problems connected with the recovery increase. It is a very simple matter to collect 50 per cent of the liquor practically undiluted from the ordinary blow pit and up to 75 per cent is not too difficult, if certain reasonable precautions are taken. But when it becomes necessary, for any reason such as state or federal regulation or the recovery of soluble bases, then the problem becomes much more involved.

In circular pits with a false bottom and the stock from one blow about 10 feet deep, all that is necessary to recover up to 75 per cent of the solids is to first flood the pit with about two feet of waste liquor, leaving the liquor drain valve closed. The stock should be leveled off, preferably with waste liquor, then covered with about two feet of water, distributed over the stock by coarse shower heads, rather than by heavy streams since the latter will bore through the stock and soon reduce liquor concentration. Only after the pit is completely flooded is the liquor gate opened. Shower water is continuously added to maintain a head over the stock. In this way the water forces the liquor downward and the line of demarkation is fairly sharp. The point at which to direct the liquor to the sewer can easily be determined and thereafter controlled by a thermostatically controlled valve. The drainage time will be from 1½ to 2½ hours. If the blow pit is so designed that the stock from one blow is over 15 feet deep, a higher liquor recovery can be secured at the expense of drainage time but additional washing will have to be provided by a vacuum washer. Up to 90 per cent solids recovery can be secured in the latter case with about a 2 per cent drop in solids content.

In a recovery system, built several years ago, with no washing in the pits but using vacuum washers in series and handling the hot pulp and liquor similar to kraft mill practice much trouble was experienced. The acid plant was the conventional Jenssen system, using a high calcium stone. A hot acid system was combined with chip packing, forced circulation and indirect heating.

The false bottoms were removed from the pits and it was planned to sluice out the stock with hot liquor to a blow pit stock chest, through a regulator and thence to the washers.

* Presented at the Annual Meeting for the National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries) February 16-19, 1953.

A number of difficulties arose immediately, the most serious of which was excessive liming throughout the entire system, including the washers. This was brought about by excessive sulphates, caused in part by the entrainment of air in the hot stock when sluicing the pits, also from the type of showers used on the washers. Alleviation of this condition was brought about by substituting a dolomite for a large part of the high calcium stone normally used. Other difficulties encountered were the failure of the linings of the pits, spouts and chests which all had to be replaced and the fact that the hot liquor drained away from the pulp so rapidly that the slope of the spouts had to be appreciably increased.

This mill makes both news and dissolving types of pulp and, as is normal, the sulphate content of liquor from dissolving pulp is higher than from news. When the mill was enlarged, blow pits, patterned after kraft blow tanks, were designed and built of reinforced concrete and used for dissolving pulp. These pits are completely self-sluicing and their use has appreciably reduced the sulphate content of the liquor and therefore liming. A description can be found in an article by P. N. Bowle-Evans in the December 1952 issue of the Pulp and Paper Magazine of Canada. Further reduction in liming was obtained by re-designing the washer showers so that air was not beaten into the stock by the water jets.

SO_3 Contents of the Waste Liquor

The difficulties which can be caused by excessive amounts of SO_3 in waste liquor have not been fully appreciated, largely because, until liquor evaporation came into the picture, the effects of SO_3 were not serious except in digesters equipped with indirect heaters.

The presence of SO_3 in the cooking acid can not economically be avoided at the present time. Some is always formed in the sulphur burner, in the acid towers and in the recovery system. Air leaks anywhere in the entire system will aggravate the condition. Then there is an appreciable increase in the SO_3 content during the cook, which is more marked when producing a soft stock. This increase is doubtless caused by the air retained in the digester and chips and it has been found that, when a digester charge is steamed before filled with acid, the SO_3 content of the blow liquor is reduced about 30 per cent.

While not conclusive, there is evidence that the type of gas recovery system and the manner in which it is operated, largely controls the amount of SO_3 in the cooking acid and therefore in the blow liquor. It is logical that this should be so. In the cold acid system, acid is pumped from the bottom of the digester and air vented to atmosphere from the top until the digester is full. In the hot acid system, it is common practice to vent all the air and gas mixture, while pumping, to the recovery system, often the low pressure accumulator. Under such conditions SO_3 formation is bound to be increased. This condition can be alleviated by venting that portion of the mixed gases, pour in SO_2, to atmosphere and returning only that rich in SO_2 to the recovery system. In either case, cold or hot acid, some air from the chips will be vented to the recovery system when the digester is first relieved and there appears no easy way by which this can be avoided. Also, when filling a digester, unless the acid storage tanks are kept under a slight SO_2 pressure, air will be drawn into the system to replace the volume of acid pumped.

TABLE I

GRAMS OF SO_3 PER LITER

	Raw Acid	Cooking Acid	Blow Liquor
HOT ACID			
Hard Stock	0.48	0.80	...
	0.85	1.09	...
	0.35	0.85	1.5
Dissolving	0.35	0.85	2.1
COLD ACID			
Easy Bleach	0.45	0.46	0.89
	0.43	0.66	0.94
Dissolving	...		1.00

Actual figures are meager but such as are available are given in *Table I.*

Evaporation

Evaporation of waste sulphite liquor has been carried out in a number of plants on this continent for years but always faced with difficulties arising from scaling. Generally, the raw liquor is partly neutralized with either magnesium or calcium oxide, then settled and filtered and the clear liquor vacuum evaporated. In no case was the liquor burned.

Such operations are not efficient either from the standpoint of steam costs or production. Shutdowns, weekly or oftener are necessary for scale removal. In a recently installed three effect falling film type of evaporator, an eight hour shut-down every 48 hours is necessary and, even in this case, the pounds of water evaporated per pound of steam is low—actually about 1.9.

Until the spring of 1952 only vacuum evaporators were used commercially on this continent, though a great deal of pilot plant work had been done

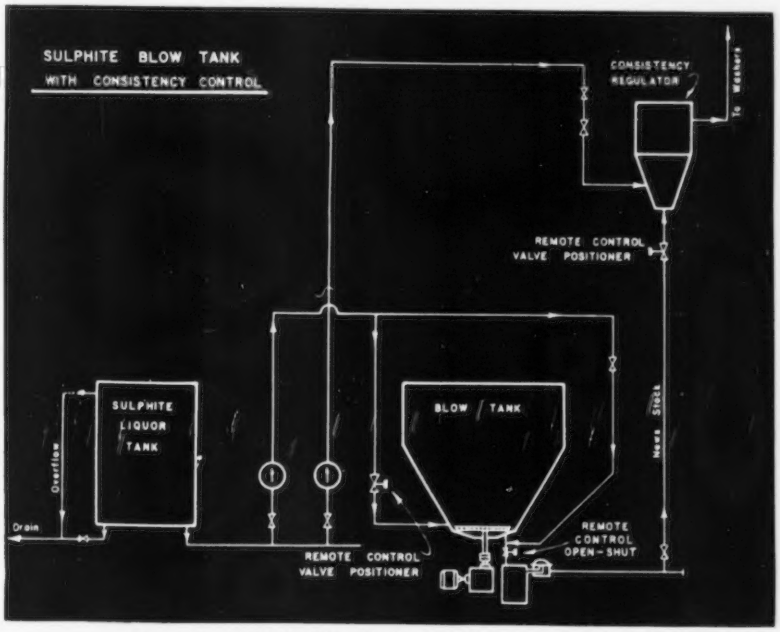

Figure 1—Sulphite Blow Tank with Consistency Control

on thermal compression, pressure and electrical evaporation.

Considering thermal efficiency alone, thermal compression ranks first, pressure evaporation second and vacuum third. Thermal compression has the disadvantage of high first cost and the fact that, unless a back-pressure steam turbine can be used to drive the compressor, power costs will be high. Pressure evaporation economy depends on finding a constant use for the low pressure steam from the last effect and in pressure evaporation scaling is more serious than in the case of the other two systems because of the greater insolubility of calcium salts as temperature increases.

In May of 1952, a thermal compression evaporator was put into operation, handling unneutralized calcium base liquor, with a capacity of 4320 gallons per hour. Operation has been quite successful with steam for evaporating at 1 pound of steam per 25 pounds of water. It is, however, necessary to shut down for a maximum of 4 hours out of 24 to clean the tubes by backwashing with the acid condensate.

This type of evaporator was chosen for physical-chemical reasons, i.e., to produce a by-product which would be changed by the evaporating process employed and it is doubtful, if the production of a concentrated liquor for burning had been the object, that a thermal compression system would have been chosen. It is estimated that, with steam at 65c per 1000 pounds, 4½ years would be required to pay for the increased first cost, above that required for a channel-switching type.

In Scandinavia, the channel-switching type of evaporator, either vacuum or pressure, has proven very successful but the first cost is relatively high and best results are obtained when the entire system, piping, pumps, valves, heat exchangers and evaporator bodies are switched at the same time. On this continent, several channel-switching type evaporators are or shortly will be in operation and information will be available on performance under conditions existing here.

In an effort to avoid scaling, pilot plant studies have been made of electrical evaporation, patterned largely on electric steam boiler operation. It was concluded that, when secondary power was available, an excellent return on the investment could be secured but with primary power, the return was greatly reduced.

Scale Prevention

In February of 1952, there was installed a scale prevention equipment known by the trade name of Cepi, at the plant of the Lenzinger Cellulosa Fabriken near Lenzing, Austria. Originally this plant had installed a Ramen system of evaporation, drying to a powder and burning. Operation was unsatisfactory due to excessive scaling, dust explosions and poor burning. In the summer of 1950, the plant was rebuilt to burn liquor rather than powder. Scaling was still very serious and the Cepi equipment was installed on a trial basis, to treat the weak liquor on its way to the evaporator.

Reports were received directly from the mill through the Vienna office of M.S.A. which confirmed the claims of the manufacturer. A personal visit to the plant was made in December of 1952.

This mill produces a beech dissolving pulp and a paper grade from spruce but only the liquor from the beech pulp is evaporated. Beech pulp production is 88 tons per day, chip packing and forced circulation with indirect heaters are used. About 70 per cent of the total solids is recovered from the digester at an average solids content of 15.2 per cent and evaporated to 56 per cent solids. The SO_3 content of the liquor averages 1 gram per liter and it has always been necessary to drill the heat exchangers on the digesters after each cook. This is not the case for the spruce digesters.

The operation of the Cepi is difficult to explain but very simply, the action can be likened to a Cottrell precipator, only in this case a liquid is being treated rather than a gas. This particular installation is a cylinder 3 feet long, 1 foot in diameter, through which the liquor passes lengthwise. During its passage it is subjected to alternating electro-magnetic fields which apparently so affect the salts in solution that, instead of forming a hard scale in the evaporator, they form a soft impalpable mud-like scale which is easily washed off. The electro-magnets are energized by 220 volt, 50-60 cycle mono-phase alternating current and require 300 watts per ton of liquor treated.

There is no question but that operation of the evaporator greatly improved with the installation of this equipment and further that old scale, which had been deposited in the evaporator bodies, pipe lines, etc., was gradually loosened and removed.

Table II shows a summary of operating conditions, covering a ten month period in each case, taken from plant log book.

A second Cepi was installed, two weeks prior to the visit, on the raw acid to the storage tanks in the hopes that the scaling of digester heat exchangers would be lessened. Since the acid tanks hold ten days' storage, the effect, if any, was just beginning to be felt but it was reported that the heaters seemed to drill easier. It was further said that the effect of the treatment wears off in two weeks. If so, the location of the Cepi, in this particular installation could be changed to a position closer to the digesters.

It is understood that a recent installation of Cepi was made in a Swedish mill without beneficial results but no details are known. In the case of the Lenzing mill, the installation cost, about $6000, was paid off in two months.

Another method of scale prevention, which has been tried out on a pilot plant waste sulphite liquor evaporator, is to provide a bed of lime salts on which the calcium sulphite and sulphate precipitate rather than forming scale on the heating surfaces. It is said to greatly increase the time between de-scaling but is quite expensive.

From all information available, the proposal to pre-heat the waste liquor to elevated temperatures under pressure, whereby the insoluble salts would be precipitated as a mud, has not worked out as hoped.

Burning

The heat value in a pound of dry solids in sulphite waste liquor lies between 7000 and 8000 BTU/lb. and the ash content averages 10 percent based on the dry solids. Both values depend on cooking variables. The net calorific value depends on liquor concentration, i.e. for 51 percent solids the figure is 3500 BTU/lb. and for 61 percent solids, 4200 BTU/lb.

Dried powder has been burned successfully but only if ground to the fineness of pulverized coal and well dispersed. Deposition of ash and un-

TABLE II

EVAPORATOR OPERATION

	Before	After
Heat Exchangers	1 mm. hard scale in 24 hours	Less than 1 mm. soft scale in 24 hours
Evaporator Bodies	⅛ in. hard crystalline scale in 4 months	No scale in 10 months
Old Scale	Had to be chipped out	Removed from the entire system in 2 months
Pounds of Water Evaporated per Pound of steam	2.24	3.49
Improvement, %		35.8
Tons of Thin Liquor per hour	15.4	22.0
Improvement, %		43.0

burned organic matter on boiler tubes and superheaters was found to be a serious drawback. Further, it is too expensive to produce the dry powder when satisfactory operation with less ash and unburned carbon in the gases of combustion can be secured with concentrated waste liquor.

From the information available, the best liquor concentration, both from the standpoint of over-all economy and handling, appears to be in the 55-57 percent range. While liquor as low as 42 percent solids has been burned, the results were far from satisfactory and even 50 percent solids gives rather poor operation. It is the general opinion that 65 percent liquor is too costly to make and difficult to handle, because it will solidify on cooling.

Early but unsuccessful attempts were made to burn the concentrated liquor on a bed of hog fuel, but in present day operation the liquor is sprayed into the furnace, in a manner quite similar to fuel oil, either mechanically or with compressed air or steam.

The evaporated liquor of 50-60 percent solids content has a higher viscosity than fuel oil and, if the same degree of fluidity is required, the liquor will have to be heated to between 212°F. and 285°F.

Attempts to burn 50 percent liquor alone, in a furnace without water walls, resulted in incomplete combustion which, in turn, caused plugging of the furnace and lowered efficiency. Even when burned with other fuels, results may or may not be satisfactory depending on furnace design, heating surface and fineness of the liquor spray. Unburned carbon in the fly-ash can result in a loss of efficiency of 5-6 percent. When pulverized coal is used as the auxiliary fuel, it is possible to keep the heating surfaces free of ash by the frequent use of either air or steam soot blowers. Scale deposits may still have to be cleaned off mechanically and the presence of sodium or potassium salts, such as would be present in the liquor from salt-borne wood, aggravate the condition.

If oil is used as the supplemental fuel, the furnace must be large with ample water walls. The first bank of tubes should be widely spaced and a suspended type of superheater used, otherwise the tubes and superheater will be completely sealed over in a short time. The scale so formed can only be removed by a lengthy shutdown and washing the tubes with water.

From several short burning tests in this country, no difficulty was experienced in burning concentrated liquor along with pulverized coal in modern water-walled furnaces. The calculated boiler efficiency was 72-75 percent, the normal efficiency for coal was 83 percent.

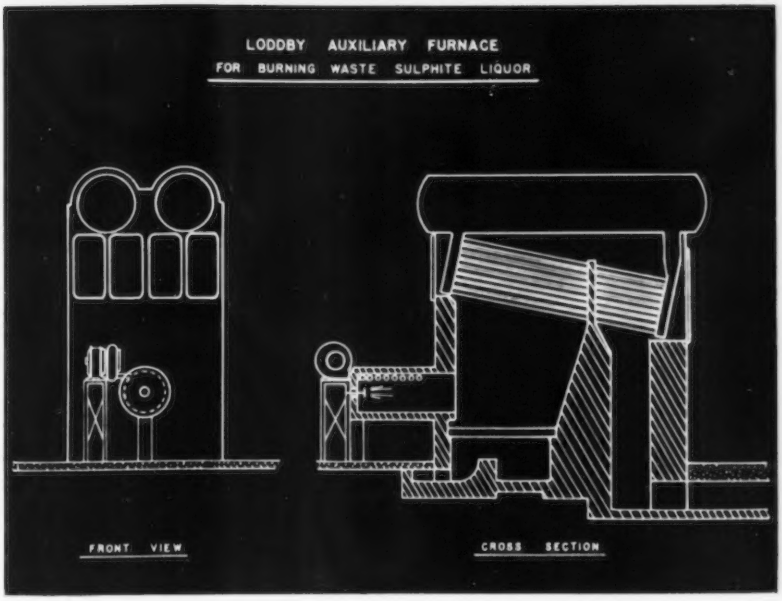

Figure 2—Loddby Auxiliary Furnace

It should be remembered that these tests were of short duration and difficulties, which might show up in continuous operation, were not encountered.

An important contribution to the technique of liquor burning has been the development of the Loddby auxiliary muffle furnace. This consists of a fire brick lined cylinder with open end connected to the steam boiler furnace. The waste liquor is steam atomized at the opposite end and combustion air introduced tangentially. (See *Figure 2.*) It is said that combustion of the liquor is 80-100 percent complete in the muffle and that waste liquor can be burned alone without difficulty but there still remains the problem of ash and scale deposition in the boiler.

Experimental runs have been made in this country which included changing the location of the muffle furnace from the front to rear of the fire box also discharging it downward. Results on continuous operation are not available.

At the plant of the Lenzinger Cellulosa Fabriken in Austria, visited December 1952, a furnace of new design for burning waste sulphite liquor was put into operation about a year ago. *(Figure 3.)* It is a circular vertical shaft about 33 ft. high and 15 ft. inside diameter. The concentrated liquor, at 100°C. and 56 percent solids, is atomized by superheated steam through 4, 6 or 8 air cooled nozzles, depending upon the capacity desired, and sprayed downward. There is an inner circular chamber, 10 ft. in diameter, extending about three-fourth of the height, in which combustion takes place. The hot gases rise upward against the down coming liquor, then pass downward, through the annular space between the inner and outer chambers, to the boilers. Secondary air at 150°C. is admitted tangentially through tuyers at the base of the inner chamber. The furnace is connected to two converted coal boilers and dust collectors are installed in the breechings leading to the boilers. Steam required for atomizing is 68 pounds per ton of thick liquor. The maximum capacity of this furnace is 11 tons of 56 percent liquor per hour. The fire looked very clean, quite turbulent and free of smoke. Temperature in the combustion chamber rises to 1300°C.

The boilers operate at 73 percent efficiency and from 1 ton of 56 percent liquor, produce 5 million BTU or 2270 BTU per pound. The CO_2 in the stack gas 10 percent and the SO_2 content is 0.3 percent. The ash amounts to 10 percent of the total solids and carries not more than 1 percent combustible. It appears to be comparatively coarse and Venturi type separators are 85 percent efficient. Because of the SO_3 content of the gas, temperature in the economizers must be maintained between 180°-200°C. (392°-432°F.) to prevent condensation.

A U. S. patent has been granted to the inventor, Ing. Fred Kann. A furnace of similar design is now being built in Finland.

Ash from burning waste liquor will average 7-10 percent based on the dry solids or about twice as much as derived from coal. In the short tests,

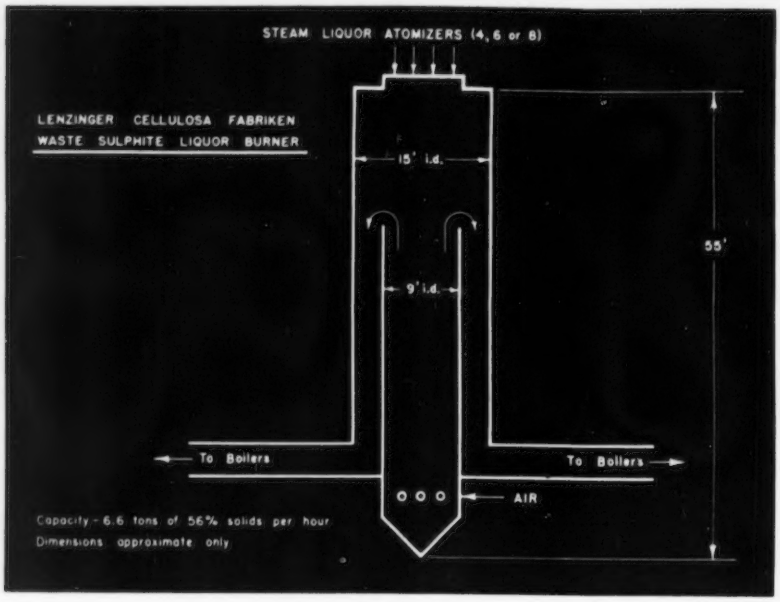

Figure 3—Lenzinger Liquor Burner

mentioned previously, about 20 percent of the ash escaped to atmosphere and the multiclone efficiency was calculated at 74 percent, which figure agrees with Swedish practice.

The total solids per ton of pulp are between 2200 lbs. and 2400 lbs. With 90 percent solids recovery, a 100 ton mill will be faced with the problem of disposing of some 7 to 9 tons of ash a day. The ash is very light and fluffy, consisting largely of dead burned calcium sulphate and carbonate and can not be disposed of as a dry powder. Probably the best way would be to mix to a slurry and pump to a disposal area. It is possible that some economic use may be found for the ash but, at present, ash disposal will add close to 85c a ton to the operating costs.

If combustion is not complete or the ash recovery system not efficient, in many localities complaints will arise because of air pollution caused by both the burned ash and unburned carbonaceous matter. In addition, it is quite possible that the SO_2 content of the stack gas will be sufficiently high to damage vegetation under favorable topographical and meteorological conditions, particularly during the growing season. The Lenzinger mill, although located in a sparsely settled district and discharging the furnace gas, mixed with gas from coal fired boilers, from a 490 ft. stack, does have occasional complaints because of fly ash damage.

About 75 percent of the sulphur in waste liquor is converted to SO_2 in the furnace and the concentration in the stack gas will average between 0.5 and 0.8 percent, the latter being theoretical with perfect combustion. At one plant careful determinations were made of the SO_2 content of the air at some distance from the plant and it was felt that even the maximum concentration found would not be harmful to vegetation. Any mill which now has complaints of air pollution from normal operation is bound to encounter serious trouble when burning waste liquor without SO_2 recovery.

There is, of course, the possibility of recovering SO_2 from the stack gases by cooling and absorption, but only if liquor alone is burned. If mixed with other fuels, the SO_2 concentration will be lower in proportion to the relative amounts of the two fuels and probably not worth recovering unless air pollution should be a factor.

Soluble Bases

While there have been no new commercial developments in chemical recovery when using soluble bases, magnesium, sodium and ammonia, in the cooking liquor rather than calcium, a brief review of the present status will be in order.

Interest in the use of ammonia has continued high but as of now, it is proposed to recover only SO_2 from the furnace gases. An interesting U. S. patent No. 2,596,241 (May 13, 1952), issued to Donald Helleur and assigned to Price Brothers, describes the recovery of ammonia from waste liquor by the addition of MgO to the liquor before evaporation, by which ammonia is released and the cyclic recovery of MgO and SO_2 from the stack gas. So far only laboratory trials have been made but it is said that the reaction goes largely to completion with ease.

The University of Washington has been working on ammonia recovery through ion exchange and at the University of Maine work has been done on mixing kraft liquors with ammonia base sulphite liquors for chemical recovery.

Though several mills are using ammonia base liquor, only those at Lebanon, Oregon and Appleton, Wis., are planning SO_2 recovery. Commercial operation is not yet under way. The Toten mill in Norway has been cooking with ammonia for some years but with no chemical recovery.

The Stora Kopparberg mill at Skutskar has been using a soda base liquor and recovering sodium and SO_2 for years, by a rather complicated process. Chemical recovery is reported high.

The Aries-Pollak Sulfox process proposes the recovery of sodium and SO_2 by controlled oxidation but has not progressed into commercial operation.

Summary

Liquor collection poses definite problems for pulp mills using either the calcium base or the soluble base sulphite process. This is particularly true if pollution abatement is to be successful.

Sulphate formation, in quantities, sufficient to cause serious difficulties is an ever present danger when a calcium base is used.

With either calcium or soluble base liquor the installation costs of efficient liquor recovery equipment will be substantial and may even approach or possibly exceed the cost of evaporating equipment or furnaces.

Most of the technical problems of evaporation have apparently been solved by the use of the channel switching type of plate evaporator, though trouble will still be experienced from scaling if the sulphate content is excessive. The installation is costly and operating and maintenance costs will probably be high.

Concentrated waste liquor, irrespective of base, can be burned alone or with auxiliary fuel quite satisfactorily in properly designed equipment.

The burning of a calcium base liquor introduces the serious problem of air pollution from fly ash and the SO_2 content of the stack gases. The equipment used so far for fly ash removal from the gases has not proved effective and new or improved equipment will have to be developed. Ash and scale deposition on the boiler tubes, collection and disposal of the large amounts of very fluffy fly ash, will add to the operating problem and materially increase operating costs.

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Spent Sulphite Liquor Pollution Abatement Programs In the Pacific Northwest

Herman R. Amberg

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National Council for Stream Improvement, Inc.

There are at the present time a number of pollution abatement programs initiated by the sulphite industry of the Pacific Northwest which may be of considerable interest to mills in other sections of the country.

Hydrological conditions in the Northwest are such that a pollution problem exists, at most, for approximately 120 days during the summer and early fall. The remainder of the year, stream flow is sufficient to supply adequate dilution to prevent low oxygen levels associated with excessive sulphite waste pollution.

For clarity of presentation this paper will be divided into five phases dealing with the control or abatement of sulphite pollution by the following means: (1) Road binder, (2) storage lagoons, (3) submarine diffusion lines, (4) soil conditioning, and (5) irrigation.

The first three methods have been carried on to actual full-scale installations, handling the entire mill sulphite waste, whereas disposal of spent sulphite liquor by irrigation and soil conditioning is at an experimental stage.

Road Binder Program

At the present time there are two mills in the Northwest that have undertaken an extensive road binder program. In general, sulphite liquor applied to secondary roads binds the fines and gravel into a hard shellac-like surface. Application of the liquor to secondary roads has been effective in maintaining secondary roads in excellent condition at relatively low costs, cut down on dust, and prevented the loss of valuable fines from the road bed.

Mill "A" is located in eastern Washington where the annual rainfall is less than 15 inches. In 1952, this mill started selling spent liquor in April and ended the program in October; a total of 16.2 million gallons of liquor being sold. During the months of July and August the entire volume of liquor was sold, and during the spring and fall approximately 70 to 80 percent of the total output was sold. It must be noted, however, that climatic conditions east of the Cascades are ideal for this method of disposal since less than one inch of rain falls during the summer months.

Mill "B," located in western Oregon, gave approximately 5.5 million gallons of spent liquor to county road agencies for use in stabilizing secondary roads. In western Oregon the season is somewhat shorter than each of the Cascades, but in general the rainfall during the summer will be less than one inch.

It is estimated that at an application rate of 1.3 gallons per square yard, the cost of treating one mile of road with an average haul of 15 miles, is approximately $100. As a rule the application is much lower; many of the roads receiving only 0.5 gallon/square yard.

It is often stated that one disadvantage of the sulphite liquor road binder is its solubility after a rain. In the Pacific Northwest this has been shown to be advantageous because the roads soften up after the winter rains and can readily be worked and graded in the spring. In regions where rainfall is equally distributed throughout the year, considerable loss of liquor would be experienced after each rain.

In general, the road binder program has been well accepted by the public, and the use of spent liquor for this purpose will undoubtedly increase in the future. However, considerable public relations work and salesmanship is required to develop a program of any magnitude, and it is estimated that under optimum conditions the liquor from 40 tons of sulphite production per day can be used within a 25 mile radius of the mill during the critical summer months. At best this method of disposal is limited to the small mills.

Storage Lagoons

There are four storage lagoons in operation in the Northwest. These installations are designed to hold the blow liquor plus the first washings for approximately 120 days, and are discharged during the rainy season in accordance with stream flow. The liquor discharged to the ponds has a pH in the range of 2-3 which prevents bacterial action and subsequent odor problems. At this low pH and high strength no appreciable stabilization of the waste occurs, the only reduction in BOD being effected by the dissipation of SO_2 or volatile constituents from the stored liquor.

The primary problem with the storage lagoons has been excessive seepage. One of the lagoons failed after a week of operation and had to be abandoned for the remainder of the summer, while another installation experi-

* Presented at the Annual Meeting for the National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries) February 16-19, 1953.

enced some difficulty at the end of the ponding season.

The two lagoons located on islands have operated successfully for a number of years without noticeable seepage. These mills have reduced their pollution by approximately 80 percent.

Two of the lagoons will have to be treated prior to use next summer. Some initial experimentation at Oregon State College has shown that the application of cement plant precipitator dust to the upper six inches of the soil is effective in reducing the coefficient of permeability to a minimum. The use of lime, cement, and sodium silicate for soil stabilization has also been effective, but where the mills are close to cement plants, the use of the precipitator dust would be the most economical treatment. The material cost of treating one acre of lagoon surface to a depth of six inches with this material is estimated to be $2000 f.o.b. (40c/square yard).

Where soil conditions are favorable, the storage lagoons have been effective as an ameliorating device, but the problem of liquor seepage always remains.

Submarine Diffusion Lines

Since the initial installation of the submarine diffusion line for the disposal of sulphite liquor at Everett, Wash., four other lines have been placed in operation in the Northwest. The Everett installation will be discussed in some detail since a comprehensive survey of water conditions in Everett Harbor was made before and after the installation of the disposal line.

The two sulphite mills at Everett discharge approximately 73 million gallons per day of combined waste which has a population equivalent of 5,000,000. Prior to the installation of the pipe line, the waste was discharged into the surface water of the Bay. In general, surface conditions with respect to dissolved oxygen were below the 5 p.p.m. state standard, and on numerous occasions during the summer months the D.O. was zero. The problem was acute in the Snohomish River estuary since migratory fish often remained in the surface waters of the estuary for several months before migrating seaward. A survey by the mills indicated that a submarine pipeline designed to discharge blow pit effluent along the floor of Port Gardner Bay would correct subnormal water conditions attributable to the mills.

The disposal section of the 3,000 foot line (last 1000 feet) lies along the bay floor at an average depth of 340 feet. It is a 30 inch (ID) creosoted wood stave pipe fitted with stainless steel bands. One hundred and ten stainless steel nozzles, each one foot in length, with an inside diameter of three inches, are spaced along the top of the section to give a uniform discharge pattern. Sections of the line are connected by means of stainless steel ball and socket joints and two ton concrete anchors placed at 50 foot intervals hold the line in position. Total flow through the line is about 12,500 g.p.m. when the mills are operating at normal capacity.

Since the pipeline has been in operation, surface conditions in Port Gardner Bay and at the mouth of the Snohomish River are above the 5 p.p.m. D.O. standard set by the state. The effectiveness of the pipe line may be summarized as follows:

1. Surface pollution by pulp mill effluents has been reduced to a minimum and a pollution barrier to migrating fish no longer exists in the Snohomish River estuary. This is extremely important for the small salmon fingerlings which swim largely in the surface waters, and often remain in the estuary for several months.

2. Generally, the pipe line has been effective in reducing 90 per cent or more of the pollutions at stations that previously did not meet standards.

3. Excellent distribution and a certain degree of stratification of the waste at lower depths have been effective in reducing objectionable color in Port Gardner Bay and Possession Sound, permitting greater penetration of sunlight and thereby increasing photosynthetic activity of algae.

Three pipe lines have bee ninstalled at mills discharging into the Colombia River. Surveys conducted by the state indicate dilution has been increased 20-fold by the installation of these diffusion lines.

The diffusion lines have been very effective in minimizing localized pollution in the vicinity of pulp mill outfalls. However, the initial cost of these lines is high and considerable expense is involved in maintaining the lines in good operational condition.

Soil Conditioning

In recent years considerable attention has been focused on the rapid loss of organic material or humus from the soil, caused by mismanagement and poor conservation practices. Increases in population will necessitate greater productivity per acre of available tillable land, and this can only be accomplished by returning to the soil organic residues that are now being wasted.

The work on the use of spent sulphite liquor as a soil conditioner up to date has been experimental and no large scale application has been tried. In general, it has been found that an excellent soil structure can be obtained through judicious use of spent sulphite liquor. Since the spent liquor is deficient in nutrients, an ample quantity of well balanced fertilizer should precede the sulphite treatment. In this respect, ammonia base liquor will require no supplemental nitrogen, since the liquor contains sufficient nitrogen for the microbial decomposition of the organic materials present in the waste and for plant growth.

Experiments conducted at Oregon State College showed that application of calcium base liquor below 80 tons/acre to the soil increased general microbial activity. The sugars and lignin in spent liquor stimulated a response of part of the soil micro-organisms not unlike that produced by an equivalent amount of organic substance added as straw. As a source of immediately available energy, the sugars have potential values for increasing nitrogen fixation by *Azotobacter* and certain other soil bacteria. Sulphite liquor can also serve as a sulphur fertilizer since about half of the total sulphur content can be considered readily available as sulphate.

All of the experimental work conducted to date indicates that sulphite liquor has a beneficial effect and the cumulative effect of humus on the productivity of the soil should not be overlooked.

Irrigation

In the last two years two hardboard mills have disposed of their white water and cooling liquor by irrigation. The operation of one mill will be discussed, since insufficient data are available from the second mill.

Because of the critical nature of the receiving stream, waste disposal at this mill must be accomplished during the summer without adding any pollutional load on the stream. This was a real problem since the mill produced waste white water and cooking liquor at the rate of 0.5 MGD. The waste had a B.O.D. of 2000 p.p.m., a total solid content of 4500 p.p.m., and a pH of 4.1.

A contract was arranged with one of the adjacent farmers in which he agreed to use the waste to irrigate 20 acres of corn, 5 acres of clover, and three acres of grass crop. In return, the company furnished the wastes to the farm under pressure and paid the cost of moving overhead sprinkler irrigation systems.

(Continued on page 31)

Present Practice In Treating Papermaking Effluent

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The problem of clarifying paper machine overflow waters to a point where they can be discharged without deleterious effect to receiving waters is in many cases a problem distinct from the salvage of papermaking materials from these effluents. The reasons for this are as follows:

(1) The residual suspended matter in the overflow is not suitable for incorporation in the product or could be incorporated only at a penalty in production, quality of product, or operating difficulties.

(2) Saveall equipment of sufficiently high clarification efficiency to satisfy discharge requirement cannot be obtained, is unsuited to the operation in general, or is incapable of functioning with the necessary degree of uniformity.

(3) Grade and color changes of high frequency during which saveall equipment is inoperative.

(4) The unavailability of saveall equipment to clarify washups, spills, floor drainings and other miscellaneous waste waters.

Under these conditions further clarification of the effluent other than that provided by the mill white water system becomes necessary. In addition to this, a means for the disposal of the residue of sludge obtained from this process must be provided where no use can be made of it.

During the past ten years, final clarification of paper machine effluents has resolved itself to a point where a general procedure has been established which can be considered as standard practice.

In approaching the problem of providing final clarification, the first step is to segregate the flows requiring treatment so that the equipment required can be reduced to minimum size. The determination of whether a particular flow should be incorporated in the effluent to be clarified or not is dependent upon both the nature of the suspended matter present in it and its concentration in relation to the clarified effluent which is acceptable for discharge.

The second step is to provide means whereby the flow of the effluent requiring treatment can be discharged at as uniform a rate and most constant a temperature as possible. These factors are important both from the standpoint of equipment size and satisfactory operation.

Prior to pumping, if such is required, and clarification, screening of the effluent is necessary to prevent large debris from causing mechanical difficulties. Generally, bar racks with openings between the bars of between one-half and one inch prove satisfactory for this purpose in most installations. These devices are generally manually cleaned but the trend is toward the use of mechanically cleaned racks because they minimize the attention problem and labor of the manually cleaned units.

When the effluent must be raised to a higher level, a pumping station must be provided. This can, to some degree, be employed as a flow equalizer as a pump well usually has to be installed. Such a well should be designed on the basis of a definite pumping schedule (for each major condition of mill discharge) incorporating sound flow data, pump ratings and control equipment characteristics, so that as even a flow to the treatment unit as possible is provided.

Pump wells should not be made excessively large, not have flat bottoms or sides with slopes less than 60 degrees. If these principles are followed and suction connections are placed near the bottom of the well, troubles due to deposits of settleable solids and the attending odorous decomposition will be avoided. Pumps employed to best advantage are centrifugals of the trash type commonly used for handling sewage as clogging and impeller deposit troubles are largely eliminated by these. Every effort should be made in designing, erecting and operating pumping stations for this purpose to eliminate entrained air from entering the system.

Under some conditions it is necessary to remove entrained air to prevent floatation in settling devices. The best and simplest means for doing this apears to be spreading the flow across a wire with an apron attached to carry the discharge without turbulence. Another adaptation of the same principle is to pass the flow upward through a pipe of large diameter and allow it to discharge at low velocity at the apex of a flat cone and run down the sides without drop. The more complicated diaerators, such as those employed for boiler water, do not seem to produce as good results as the types described above.

Clarification of the waste water is generally accomplished by means of sedimentation. This does not mean that other forms of clarification such as floatation or filtration cannot be satisfactorily employed but that this method has been most commonly selected by the industry. This selection was made mainly because of capital operating cost, ease of operation and flexibility. Sedimentation units now in service are of four general types. These are as follows:

(1) Settling tanks not employing mechanical sludge collecting devices.

(2) Settling tanks employing mechanical sludge collectors or thickening mechanisms.

Paper presented at the National Council for Stream Improvement (of the pulp, paper and paperboard industries), Annual Meeting, Feb. 16-19, 1953.

(3) Upflow clarifiers not employing mechanical sludge collectors.

(4) Upflow clarifiers employing mechanical sludge collectors.

Either the normal or upflow types can be employed whether or not the effluent is flocculated with coagulants, although the conventional type is preferred without coagulation and the upflow type with. In *Figure 1* some common types of clarifiers are depicted. Each type has its advantages and limitations from the standpoints of design, operation and maintenance. Choice of the best type for a particular job depends upon the character of the waste water, physical layout, effluent clarity desired, the density of sludge required and the degree of supervision provided in the operation. Conventional types are less sensitive to waste flow and temperature fluctuations and require less attention than upflow types. As a rule they do not produce as high a degree of clarification and must be operated at somewhat lower overflow rates than the latter. This means a larger size unit for equivalent flows.

Displacement detention periods for conventional types should not be less than two hours at maximum sustained flows. In upflow units this period can be safely reduced to 1½ hours and in some cases, where coagulants are employed and control good, to possibly one hour.

TABLE I—REINFORCED CONCRETE SETTLING TANK COSTS

Tank diameter, ft.	30	40	65	80
Capacity, mg.	0.75	1.35	3.54	5.40
Cost:				
Settling tank	$12,000	$15,000	$26,500	$35,000
Mechanism	4,300	5,000	9,000	9,700
Installing mechanism	750	1,000	2,000	2,500
Total Cost	$17,050	$21,000	$37,500	$47,700
Flow, mgd.	1	2	3	4	5
Ratio of cost	1	1.4	1.8	2.2	2.5

It can readily be seen from *Table I* that the installation of clarifiers of too small a size is false economy. Examination of these figures reveals that a considerable increase in capacity can be purchased at a relatively small fraction of the overall cost of a smaller unit. For example, a unit capable of handling 2 million gallons a day costs about $26,000, and one capable of handling 2½ million gallons daily $29,500, or an increase of only $3,500 for 20 percent additional capacity. In the case of large clarifiers this differential is even greater.

Clarifiers employing collector mechanisms are as a rule capable of discharging a much more compact sludge than those not so equipped. However, conical settling tanks having a high side slope can produce a compact sludge if the slope is greater than the angle of repose of the sludge so that it will drop to the bottom of the cone and compact. For this reason this type of clarifier is quite popular, since obtaining of a compact sludge is not dependent upon the operation of a mechanical device. They do, however, have size limitations and a greater head requirement.

Collector mechanisms employed in clarifiers of the circular type are usually either normal light or heavy duty types, the latter being employed when

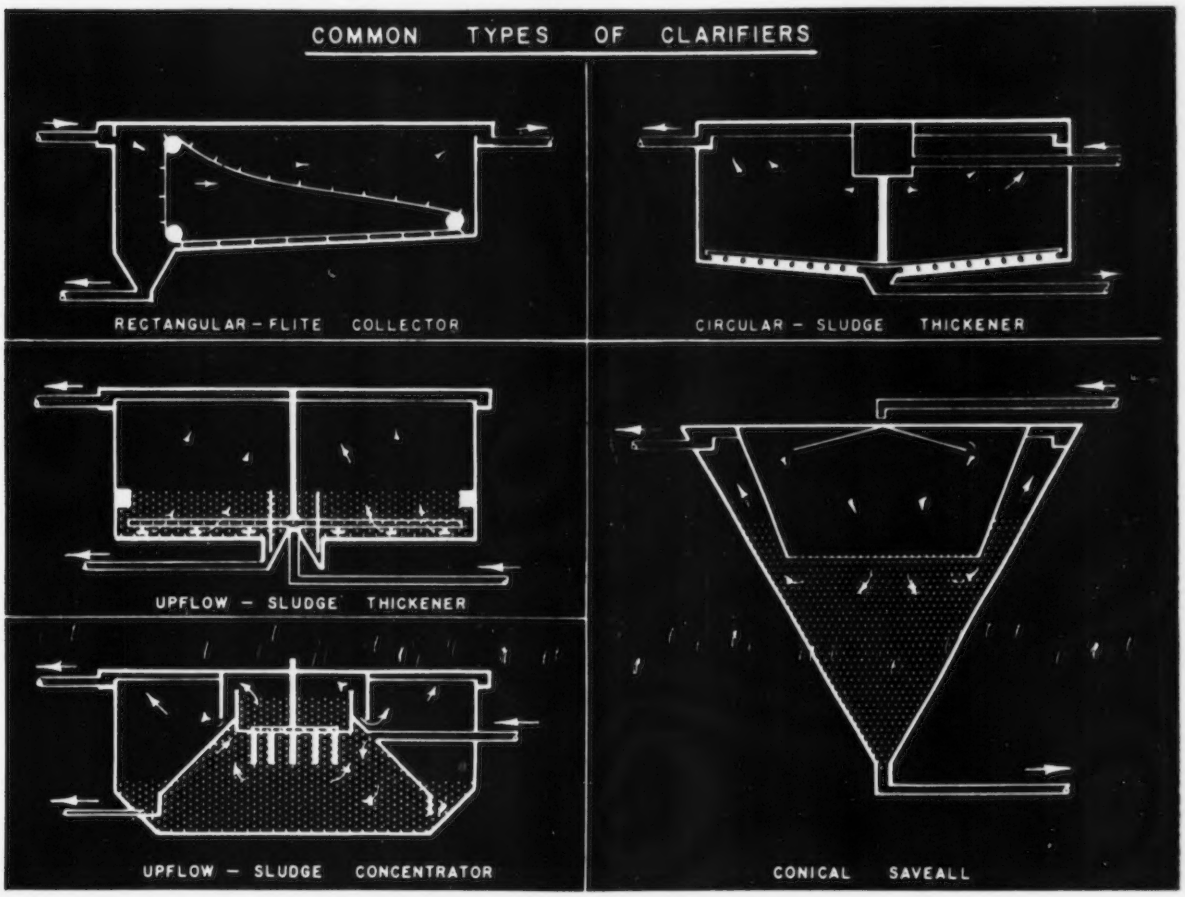

Figure 1—Common Types of Clarifiers

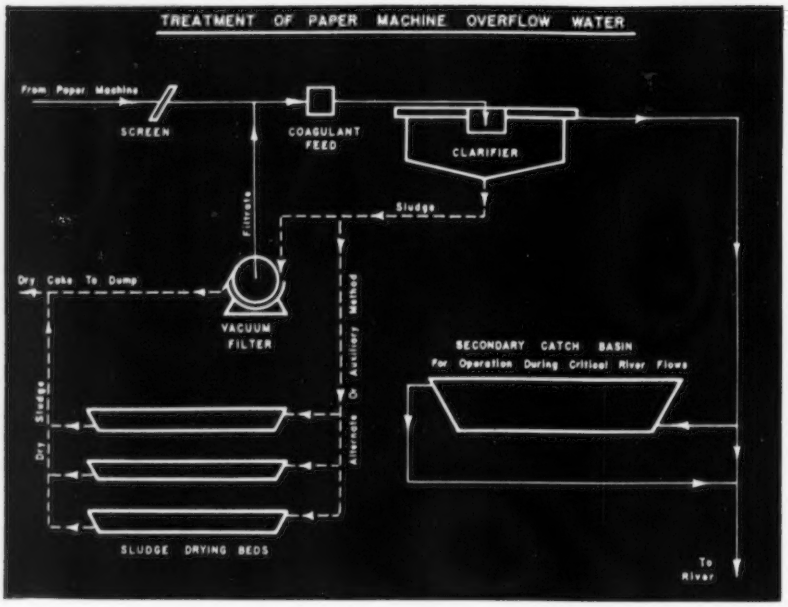

Figure 2—Treatment of Paper Machine Overflow Water

slurries which can compact to a density greater than 5 percent solids are to be handled. In the case of units of large diameter, or where clay or carbonate is present in the waste in considerable quantities, the heavy duty type is preferable and sometimes a necessity. Whichever type is used, it is well to have it equipped with a rising mechanism to prevent stalling under heavy load. These raise the collector blades so that they ride high in the sludge blanket until the bulk of the sludge is removed.

A properly installed and operated settling device operated without coagulants will reduce the settleable solids content of machine waters in excess of 95 percent. The accompanying reduction of the total suspended matter depends entirely on waste characteristics. These reductions generally vary between 60 and 85 percent for machine waters. However, performance under these conditions must be rated on settleable solids reduction as removal of non-settleable material cannot be expected.

When coagulants are employed, a reduction in total suspended solids in excess of 85 percent can generally be attained. Because percentage removal figures are so greatly influenced in this case by initial concentration, perhaps a better measure of clarification efficiency is the residual concentration of suspended solids in the effluent discharged. Performance records of a number of these units operating with adequate chemical coagulation indicate that effluents averaging between 0.2 and 0.4 pounds per thousand gallons, or between 25 and 50 p.p.m., can consistently be produced. While a higher degree of clarification is at times evident, average results will rarely be appreciably below 25 p.p.m. and better performance than this should not be anticipated. Generally this high degree of clarification is satisfactory but in some cases objection has been made to the appearance of effluents which contain titanium dioxide or other extremely fine fillers. Minute concentrations of these materials can impart a distinct millsy appearance to the discharge. It is doubtful if coagulation and sedimentation alone, as now practiced, can correct this condition.

Under critical discharge conditions, where during the dry season the receiving stream cannot absorb the occasional loss of suspended solids occurring during irregularities in clarifier operation, it is well to provide a catch basin behind this unit in the form of a small earthen lagoon providing a detention period of about four hours. *(Figure 2.)* This device should not be depended upon to do the work of the clarifier or supplement it for any long period of time, but serve only to protect against unavoidable operating irregularities. If so operated, accumulation of solids in it will be very slow and cleaning necessary at infrequent intervals. These basins are sometimes provided in duplicate. This should not be necessary when the dry season is relatively short and operation is carried out in accordance with the recommendations made above. A sludge drying basin which is out of service can be used for this purpose.

The greatest problem and largest operating expense involved in the entire clarification system is generally dewatering and disposal of the residual sludge. Cost depends primarily on the quantity and characteristics of the residues. These are delivered from clarifiers under hydrostatic head or by means of plunger or screw pumps at concentrations of from 0.5 to 10 percent solids, the consistency being contingent upon the type of unit, the method of operation and the basic nature of the sludge. Most slurries resulting from the treatment of machine waters will compact to at least four percent solids and a properly designed and operated clarifier can deliver them at such an average consistency.

Most sludges exceeding five percent solids can be dewatered on vacuum filters to a cake solids content of from 20 to 30 percent. This results in a volume decrease of as high as 600 percent and puts the material in a readily handleable and generally stable form for final disposal in a dump or fill area.

Decantations and drying basins are also in common use for this purpose. These are generally shallow basins which receive the sludge directly from the clarifier and are employed in multiple. When a basin is full, it is taken out of service, free water allowed to decant from the sludge layer and drainage and drying allowed to proceed until the residue can be removed or spread with oil and burned.

Successful and economical operation of drying basins depends upon their construction, with regard to drainage, climate and limiting the depth of the decanted and drained sludge. Data concerning the factors affecting the operation of such basins were published in Council Technical Bulletin # 14.

Unfortunately, all residual sludges obtained from the clarification of machine water do not respond to the dewatering techniques touched upon above. Those consisting mainly of groundwood fines and others from mixed papermaking operations will not thicken or dewater to a satisfactory degree. These are in the minority and it is believed that research will eventually provide a method for handling them.

The items of value which are recoverable from machine water clarification operations are water and heat if the system uses hot water. While the latter can be a large item the former can be even more important as manufacturing operations grow large in areas where water is becoming decreasingly less plentiful during the dry season. The ability to successfully employ well clarified effluent in mill services unable to reuse the usual saveall effluent on a continuous basis is rapidly being appreciated.

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Semi-Chemical Pulping Waste Treatment

Robert E. Opferkuch

Project Leader, Virginia Polytechnic Institute Project, N.C.S.I.

One of the fastest growing branches of the pulp and paper industry in recent years has been semi-chemical pulping. The term semi-chemical, as most of you know, denotes a process of producing wood pulp wherein roughly half the amount of chemical is used which would be required by the traditional chemical processes. The degree of cooking of the chips, in semi-chemical pulping, is also greatly reduced as compared with the kraft and sulphite methods. That pulp can be produced under these conditions is dependent upon extensive use of attrition mills for mechanically defibrating chips softened by cooking. The combination of these techniques results in a high yield of pulp containing a large amount of original wood materials including mainly lignins and hemi-celluloses. While the pulp yields a board of relatively good quality it was the general opinion for a number of years that semi-chemical pulp was too inferior in quality for the production of better grades of paper. Recently, this opinion has been refuted and we now find greater and greater quantities of semi-chemical pulp being bleached and used in furnishes for the better grades of paper including magazine and book.

By comparison with the "full chemical" cooks, the semi-chemical process has the following advantages:

1. Less chemical required.
2. Higher yields of pulp.
3. Better paper characteristics in some respects.
4. Less capital cost.
5. Utilization of hard woods.
6. Reduction in pollutional load.

This last advantage applies only to a comparison of semi-chemical and acid sulphite and not to a comparison with the kraft process since the practice of chemical recovery was instituted in the latter.

The major disadvantages of the semi-chemical process are:

1. Lack of chemical recovery practice.
2. Resistance of the waste liquors to treatment for disposal.
3. Inferior paper characteristics in some respects.

These disadvantages apply in part also to the sulphite process. Nevertheless, I believe it can be seen that the advantages of semi-chemical pulping outweigh the disadvantages to an extent which would appeal to many a pulp producer considering ways and means of increasing tonnage. Obviously, if the first two disadvantages could be overcome satisfactorily, and by satisfactorily I mean economically, the semi-chemical process would indeed be a very desirable means of producing a useful pulp.

Resistance to Treatment

Let us look first at the second disadvantage listed above: Resistance of the waste liquors to treatment for disposal. In 1947, the National Council opened a research project on semi-chemical wastes at Virginia Polytechnic Institute. The experimental results obtained on this project, together with similar results obtained through independent research at various other institutions, are what prompt the statement: resistance of the waste liquors to treatment for disposal.

Before enumerating the various avenues of exploration at the Virginia Polytechnic Institute project I would like to point out what has been discovered about the characteristics of semi-chemical wastes. The term semi-chemical is not specific. To be specific we would say semi-kraft, semi-soda, semi-acid-sulphite or neutral-sulphite. At one time in the past, to a far greater extent than now, all of these semi-chemical cooks were in use. For various reasons an industry-wide trend developed which largely eliminated from popularity all but the semi-kraft and the semi-neutral-sulphite cooks. Further, this trend resulted in a considerable number of semi-chemical mills, perhaps a majority, electing to use the semi-neutral-sulphite cook. The following characteristics apply to spent pulping liquor or wash liquor from the semi-neutral-sulphite pulping of mixed hardwoods.

1. Total solids range from 8 percent to 20 percent on a weight basis. This appears to be a wide range for a single process but is explained as follows: (a) where mill practice is such that chips are dumped from a digester, the spent liquor draining from them averages 12-14 percent total solids; (b) where practice is such that spent liquor is recirculated, total solids may run from 18-20 percent; and, (c) where practice employs continuous pulping, the heaviest liquors are obtained as wash liquors and average 7-9 percent total solids.

2. B.O.D. from 25,000 to 60,000 p.p.m. This spread of values can be broken down as above: (a) spent liquor averages 35,000 to 40,000 p.p.m. B.O.D.; (b) recirculated spent liquor runs 55,000 to 65,000 p.p.m. B.O.D. and wash liquor runs 25,000 to 35,000 p.p.m. B.O.D.

3. Acetate content of 12-20 gms. per liter.

4. Wood sugar content, predominantly pentose in the form of pentosans, 5-10 gms. per liter.

The wide range in values here is due to a combination of: (1) individual mill operation and, (2) types of wood cooked. It was further shown that, of the total waste B.O.D., a major percentage could be attributed to two components of the waste as follows: sodium acetate, which contributes about 25 percent to the total waste solids, contributes 50-60 percent to the total B.O.D.; wood sugars, which contribute only about 6 percent to the total waste

* Presented at the Annual Meeting for the National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries) February 16-19, 1953.

solids, account for 15-20 percent of the total waste B.O.D. These two materials together account, therefore, for about 60 to 80 percent of the total waste B.O.D. and any method of waste treatment for the purpose of reducing B.O.D. must incorporate efficient means of destroying or otherwise rendering these two materials innocuous.

Methods of Treatment Tried

Without going into details, I would like to list briefly the methods tried at Virginia Polytechnic Institute for treatment of semi-chemical wastes for disposal.

1. Chemical treatment: A rather large variety of chemical coagulants were employed, alone and in combination, with the hope that the resulting floc would carry with it a substantial part of the B.O.D. Two adverse results were obtained: (a) unusually large quantities of chemical were required to produce a floc, and (b) such treatment removed only 20-30 percent of the B.O.D.

2. Oxidation methods: The treatments here can be grouped in two classes, (a) those employing sources of oxidation other than atmospheric oxygen, and (b) those employing atmospheric oxygen.

Under "a" we have: (1) Oxidation with alkaline hypochlorite and with acid hypochlorite. (2) Electrolysis.

These methods yielded a maximum of 20 percent B.O.D. reduction. Under "b" we have: (1) Aeration by cascade. (2) Aeration by diffused, compressed air. (3) Anaerobic oxidation. (4) Heat hydrolysis.

In each of these methods either one or both of the following results were obtained:

1. Maximum B.O.D. reduction was 25 to 35 percent.

2. Where higher reductions were obtained, the loadings in pounds of B.O.D. per unit per day were so low as to be impractical when the size of equipment was calculated.

As more variations of the above techniques were tried it became obvious that semi-chemical waste, especially the heavy liquors, would be extremely difficult to treat. Experimentation had been limited to the heavier liquors, in an effort to obviate having to treat large volumes of dilute waste. Experiments showed, however, that a waste of composition represented by a combination of all of the waters emanating from the pulp and paper mill appeared to be more amenable to the above methods of treatment. For instance, introduction of total mill effluent into the standard domestic sewage treatment system was shown to have no untoward effects, as long as capacity to handle it was provided. Also, recent experiments with biological oxidation of weak wastes have shown better effects using total mill effluent as compared to the stronger liquors.

An evaluation of the work up to this point emphasized the following:

1. It is impractical to attempt to remove the pollution load in the heavier semi-chemical liquors by any of the methods tried due to the chemical nature of the primary contributors to this load.

2. If the total mill effluent must be treated for disposal, the most probable means towards this end is indicated to be one or a combination of aerobic biological processes.

Chemical Recovery Systems

As the results of the above work at Virginia Polytechnic Institute and of similar efforts by independent experimentors became known, the feeling began to grow that a chemical recovery system for the semi-chemical process would go a long way toward reducing the pollutional load engendered by this method of pulping. Development work of this type had been knocking about within the industry for years, but with the sudden change in national economy precipitated by the action in Korea and with the increased emphasis placed upon pollution abatement, development work on semi-chemical recovery systems was increased considerably.

At the present time there are at least two recovery systems that have been developed by different companies. Whether these methods, when they are released, will be economically suitable for the semi-chemical process is still to be seen. However, the tide at present is strong in the direction of development of an economical recovery system.

While this type of research is understandably outside of the scope of the National Council, it was thought a worth-while venture to investigate means of concentrating semi-chemical liquors other than multiple effect evaporation. Without knowing details of any of the recovery methods perfected, it is known that concentration of the liquors to the point where they will burn is a necessary preliminary step. Consequently, this work was done with an eye to discovering a concentration method that might (a) be less costly, (b) require less maintenance, and (c) be easier to operate than multiple-effect evaporation.

Three methods of concentrating the waste liquors were chosen that seemed promising in these respects. They were: (1) submerged combustion evaporation, (2) vapor compression evaporation, and (3) selective-solvent concentration. Of these three, enough work has been done on submerged-combustion evaporation and selective-solvent concentration to show that:

1. While the operating cost of submerged combustion is somewhat higher than multiple-effect evaporation, the capital costs are less and operation is considerably easier.

2. Selective-solvent concentration, with acetone, the best solvent found to date, is far too expensive and also too complicated in operation to compare with multiple-effect of submerged combustion evaporation.

Calculated on the same basis, the estimated costs per ton of pulp for concentrating the waste liquors to a solids concentration of 60 percent are $2.40 per ton for multiple-effect evaporation, $3.80 per ton for submerged-combustion evaporation, and $7.90 per ton for the selective-solvent method. Details of these methods can be found in National Council for Stream Improvement Technical Bulletins Numbers 54 and 56.

The work on vapor-compression evaporation is still in the early stages and cannot be compared at this time.

One interesting outgrowth of the evaporation studies lies in the indicated possibility of producing acetic acid from the concentrated liquors on their way to the furnace. The liquors are somewhat richer in acetate after they have been concentrated than pyroligneous liquors from which acetic acid is produced commercially. Experimentation is underway at present on the Virginia Polytechnic Institute project to determine whether acetic acid can be produced commercially from the concentrated semi-chemical liquors.

Adaptation of a satisfactory recovery system would improve the position of semi-chemical processes in regard to pollution to a very great degree, although in some instances seasonal difficulties would probably be observed. There is good reason to believe, however, that a method of treatment similar to that developed by the Council for kraft wastes will effectively handle this residual pollutional load. Experiments to determine this were begun in the spring of last year and the study has been intensified in the last few months. The results of the early laboratory tests were promising, showing B.O.D. reductions of better than 60 percent at very high loadings. A small pilot unit is now in operation at Virginia Polytechnic Institute for further developing the process to handle semi-chemical wastes with B.O.D. greater than 500 p.p.m. and we have every confidence that this can be done.

Kraft Mill Wastes Research

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The most significant achievement, to date, of the kraft mill wastes project at Louisiana State University has been the development of an accelerated aerobic biological treatment process for the treatment of kraft mill effluents. A pilot waste treatment plant utilizing this process was operated for more than a year at the Macon Kraft Company, Macon, Georgia. Operation of the pilot plant terminated in October, 1952. The cost of construction of the pilot plant was borne by a group of Southern kraft pulp and paper manufacturers. National Council for Stream Improvement engineers operated the plant. A flow diagram of the pilot plant is shown in *Figure 1*.

The operating results have shown that it is possible to consistently obtain substantial reductions in B.O.D. of total mixed or selected individual kraft mill effluents normally discharged from the manufacturing operations. The treated effluents are free from appreciable odor and from detectable quantities of substances potentially toxic to aquatic life. The process is also capable of producing an effluent which is less colored than the untreated waste. Wastes with temperatures up to 50°C. can be treated with no decrease in efficiency.

Successful application of the process depends upon the efficiency of the kraft mill chemical recovery system and the measures taken to equalize the strength of the waste discharged to the treatment unit. Major operating costs stem from the supplementation of the kraft waste with the required nitrogen salts and the compressed air used for aeration. Construction costs will be a major consideration due to the size and quality of the structures and equipment required.

Kraft mill waste treated by this process, when added to larger volumes of untreated wastes, greatly stimulates its oxidation during lagooning, thereby reducing the detention period required to stabilize the lagooned waste. Storage periods for overall B.O.D. reductions of 60 percent can be decreased from 12-20 days to 3-5 days. In this manner, treatment of a portion of the mill effluent by the aeration method and the addition of the treated portion to untreated waste in a lagoon will serve to make storage oxidation more effective.

The development of this accelerated aerobic biological treatment process is, in all probability, the final step in resolving the problem of kraft mill waste stabilization. In view of the economic considerations, however, it is anticipated that the major application of this type of treatment will be to augment the storage oxidation treatment method which is commonly used now. In fact, the first large-scale installation of the accelerated treatment process is being used to supplement storage oxidation lagoon treatment at one of the

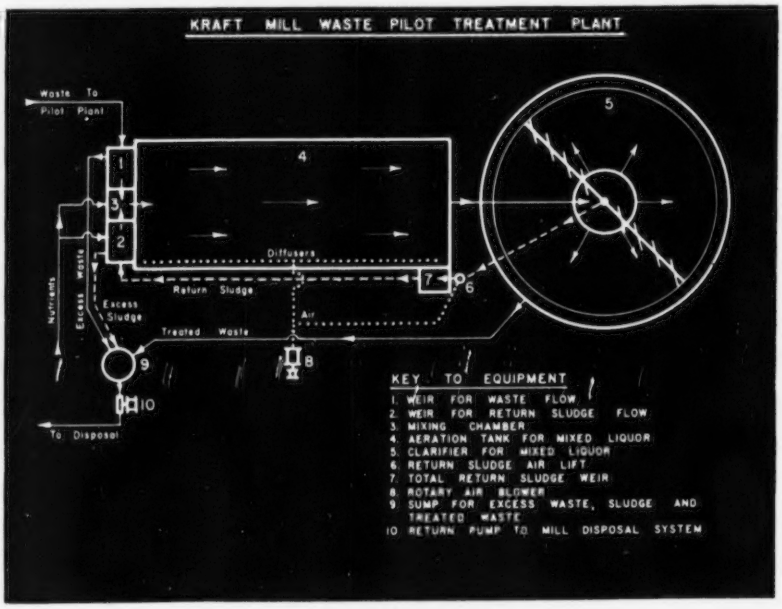


Figure 1—Kraft Mill Waste Pilot Treatment

* Presented at the Annual Meeting for the National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries) February 16-19, 1953.

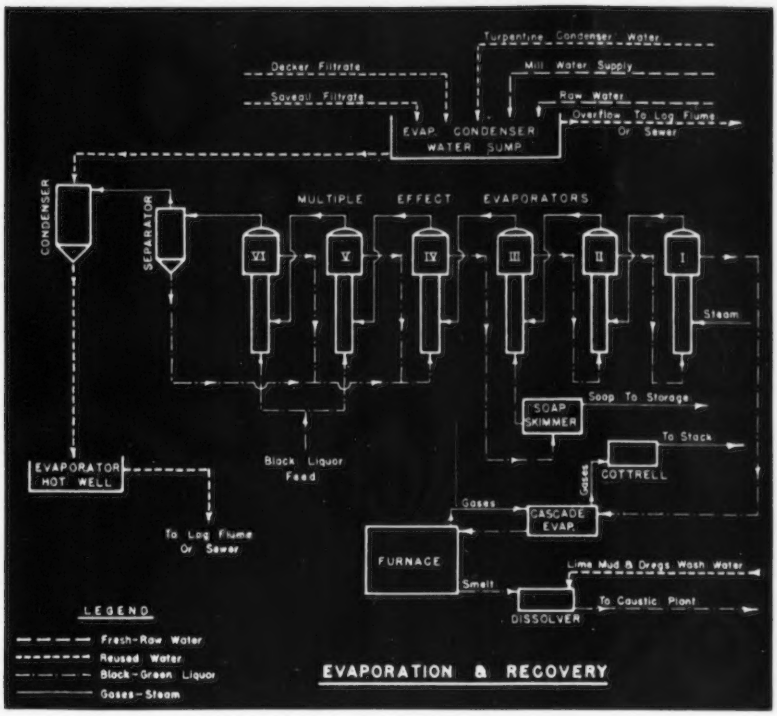


Figure 2—Evaporation and Recovery

kraft mills in the South. It is probable, however, that the accelerated biological treatment method will find application where storage oxidation may not be feasible for various reasons. The development of the accelerated treatment process also serves to make new mill sites available which previously had been considered unsuitable from a waste disposal standpoint.

In addition to the large scale installation mentioned above several other southern kraft mills are preparing designs for similar plants utilizing the accelerated aerobic biological treatment process.

Major emphasis of the kraft mill wastes project at Louisiana State University has been directed toward the problem of color removal. Undergoing investigation are chemical treatment methods using hydrated lime, directed toward the recovery and reuse of the chemicals applied. The laboratory results of one process, designated as a one-stage lime treatment process, have indicated the impracticability of this procedure. This method involved the addition of excess hydrated lime to the waste followed by carbonation to a pre-determined point, settling, dewatering of the settled sludge and finally, calcining of the dewatered sludge for the recovery of calcium oxide which would be reused. For several reasons this one-stage treatment proved unsatisfactory. Lime losses in the discharged supernatant were relatively high, even after carbonation, if maximum color removals were to be attained. Lime losses could be decreased to some degree only at the expense of color removal efficiency. At a point of compromise between lime loss and color removal the lime losses ranged from 1.7-2.5 pounds of calcium oxide per 1000 gallons of waste treated. Color removals ranged between 70 and 80 percent. Control of the optimum degree of carbonation was extremely difficult and no simple, practical control procedure could be established. Among the control methods investigated were pH, alkalinity and soluble calcium determinations, none of which proved satisfactory. Variability of the optimum point of carbonation was found to be influenced by the original pH of the waste, the adjusted pH of the waste, the initial color and the lime dosage used in the treatment.

As a consequence of the difficulties encountered in the one-stage lime treatment process for color removal the emphasis has been shifted to a multiple-stage treatment process. This procedure involves the addition of excess hydrated lime to the waste followed by clarification and separation of the settled sludge. The dissolved lime in the supernatant is recovered by carbonation, sedimentation and calcining of the settled sludge. The major problem encountered in the multiple-stage treatment process is the recovery of the lime in the first sludge which results from the addition of hydrated lime to the waste. This sludge, designated as calcium-organic sludge, is voluminous and gelatinous in character and does not lend itself readily to economical dewatering, prior to calcining, by presently available equipment generally used for this purpose.

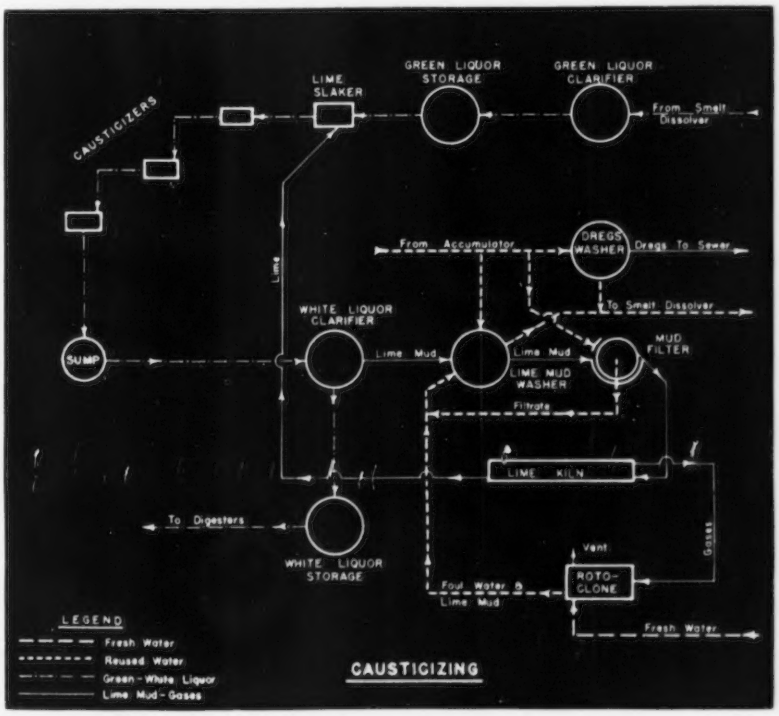


Figure 3—Causticizing

Calcining of this calcium-organic sludge, which is high in organic matter content, also presents difficulties.

Presently under investigation are several promising methods of treating this calcium-organic sludge resulting in the separation of the calcium fraction in a recoverable form. The processes involve the treatment of the calcium-organic sludge with green, or white or black liquors of the kraft pulping chemical recovery process. For the benefit of those who are unfamiliar with the kraft pulping chemical recovery system, *Figures 2* and *3* show the origin of these liquors.

The general chemical reactions involved in these treatments, as well as the reaction taking place when the waste is treated with hydrated lime, are shown in *Figure 4*. It will be noted that the major chemical reactant for green and black liquors is sodium carbonate, while in the case of white liquor, it is sodium hydroxide.

The greatest amount of investigation has been made on the treatment of calcium-organic sludge with green liquor, shown in *Figure 5*. It has been possible to obtain calcium carbonate sludges of 30 percent solids content with settling periods of 15-30 minutes and temperatures of 50-75° C. The quantities of green liquor required will vary, depending on the sodium carbonate content as well as the calcium content of the calcium-organic sludge. Chemically, the reaction appears to go to completion by the use of slightly more than the theoretical amount of sodium carbonate. The calcium carbonate sludge can be calcined to recover calcium oxide for reuse in the treatment of the waste. The resulting clear but highly colored liquor, in which the coloring matter of the waste has been concentrated, must be evaporated and burned in order to recover its soda content and destroy the organic coloring matter. This liquor may be handled

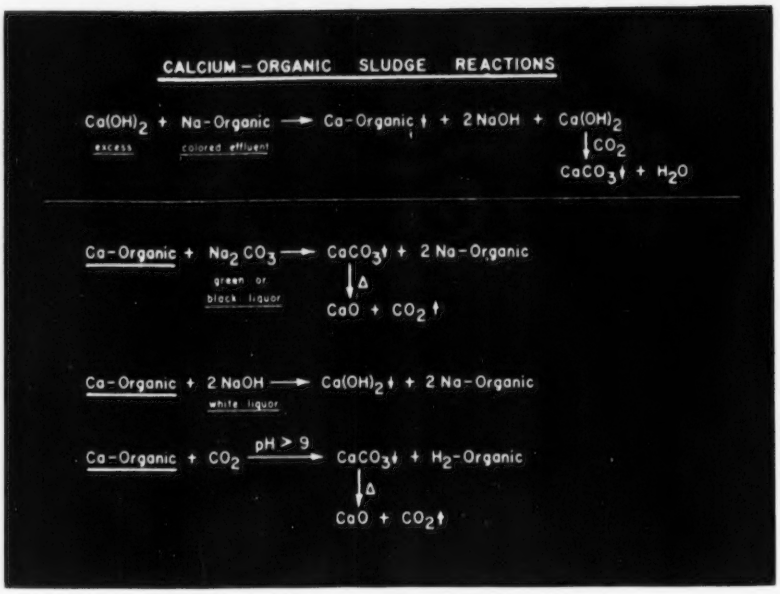

CALCIUM – ORGANIC SLUDGE REACTIONS
Ca(OH)2 + Na-Organic → Ca-Organic ↓ + 2 NaOH + Ca(OH)2
excess
colored effluent
↓CO2
CaCO3 ↓ + H2O
Ca-Organic + Na2CO3 → CaCO3 ↓ + 2 Na-Organic
green or black liquor
↓Δ
CaO + CO2 ↑
Ca-Organic + 2 NaOH → Ca(OH)2 ↓ + 2 Na-Organic
white liquor
Ca-Organic + CO2 pH > 9 → CaCO3 ↓ + H2-Organic
↓Δ
CaO + CO2 ↑

Figure 4—Calcium-Organic Sludge Reaction

by several possible methods, depending on its solid content. It may possibly be used for dilution in the pulp digesters, for washing the pulp on brown stock washers or be sent directly to the evaporators. In any event it becomes imperative that this liquor finds its way into the kraft chemical recovery system. The economics of this liquor recovery will be one of the major deciding factors in the applicability of this treatment method.

In the case where black liquor is used in the place of green liquor, the results will probably be the same. The sodium carbonate content of black liquor is lower than green liquor but it will probably be possible to utilize concentrated black liquor, in which instance the sodium carbonate content will be greater than that of green liquor. This possibility is being explored presently.

The use of sodium hydroxide or white liquor in the treatment of the calcium-organic sludge shown in *Figure 6* has undergone preliminary investigation. This method is an attempt to utilize the characteristic insolubility of calcium hydroxide in the presence of high concentration of sodium hydroxide. Successful development of this method would eliminate the need for calcining since the precipitate obtained would be calcium hydroxide instead of the carbonate thereby permitting its direct reuse in the treatment of the waste. The results obtained, however, indicated that the quantities of sodium hydroxide required would be at least three times the calculated theroetical amount. This would require the handling of too large quantities of sodium hydroxide solutions or white liquor. The economics of this method do not appear favorable, therefore, this

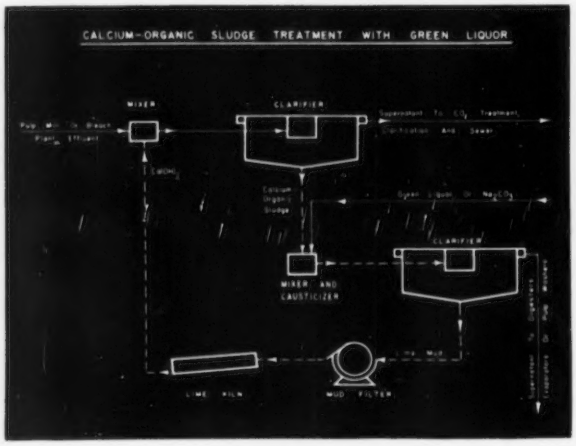


Figure 5—Sludge Treatment with Green Liquor

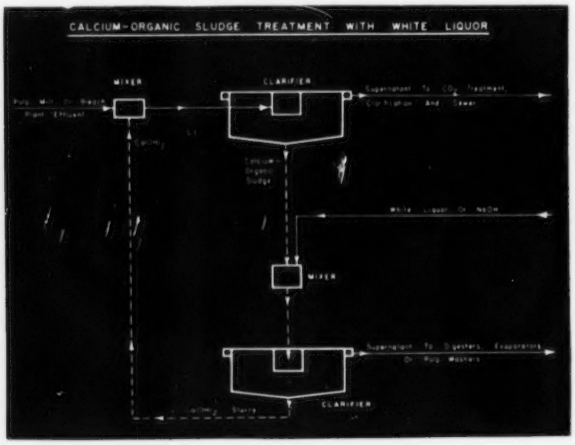


Figure 6—Sludge Treatment with White Liquor

method has been shelved for the time being.

Figure 7 demonstrates a possible method for treating calcium-organic sludge by carbonation and the addition of either green, white or concentrated black liquors. In this instance the calcium fraction of the calcium-organic sludge is converted to the carbonate by the carbonation step. The role of the added liquor is to maintain the pH high enough to permit complete precipitation of the calcium as the carbonate and to prevent the formation of the bicarbonate. The order of carbonation and liquor addition may be interchangeable. The carbonation step results in decreasing the quantities of green, white or black liquors required in the methods described previously since the primary function of the liquors in this instance is pH control. Preliminary studies utilizing this procedure have shown promise and will be more completely investigated.

It is obvious that there are many possible combinations and variations of treatment procedures which may utilize the general methods of calcium-organic sludge treatment described above. As these combinations become apparent they will be investigated in the hope of improving upon this existing procedures.

The economics of the preceding procedures will be closely associated with the costs of removing water from either the calcium-organic sludge, the resulting liquors from the sludge treatment or both. It is desirable to start with a calcium-organic sludge with the highest solids content. It is also desirable to develop a treatment process which will require the minimum change in the present kraft process recovery system and a minimum of additional equipment. Relative to the matter of solids content of the calcium-organic sludge and the resulting liquor following sludge treatment, it appears desirable, from a cost standpoint, to remove as much water as possible from the calcium-organic sludge by some mechanical means other than evaporation. The treatment methods described above have been examined with this factor in mind and the method utilizing carbonation exhibits considerable promise in this respect. It has been found possible to increase the solids content of calcium-organic sludge to 10 percent by carbonation of the sludge followed by settling. Further efforts in this direction will be continued. It may even be possible, if the proper method is developed, of increasing the solids content of the calcium-organic sludge to a point where the sludge can be calcined directly in a lime kiln and its calcium content recovered for reuse.

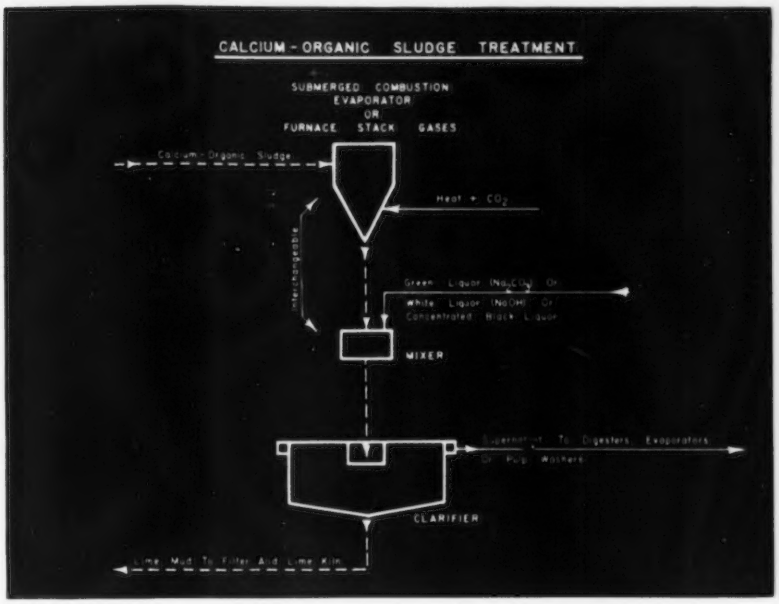


Figure 7—Calcium-Organic Sludge Treatment

This procedure would eliminate the intermediate handling and treatment proposed in the aforementioned methods. This possibility is kept constantly in mind.

No mention has yet been made of the color removal and B.O.D. reduction potentialities of the hydrated lime treatment of kraft wastes. Experiments conducted on laboratory and pilot plant scale have shown that it is possible to remove 90 percent of the color and 15-25 percent of the B.O.D. of the waste.

Pacific Northwest Program

Herman R. Amberg

(Continued from page 21)

The hydraulic loading used was 20,000 gallons per acre per day, or 0.7 inch per day. The waste did effect some changes in the soil; the pH dropped from 6.5 to 5.1, and the surface of the soil began to get more dense and slightly gummy at the end of the irrigation cycle. Since the winter rains, however, all evidence of these effects has vanished, the pH is back to 6.5 and the soil is fresh and loose.

The cost of this irrigation operation for three months was $1,248.62. Broken down, this cost amounted to $387.71 for pumping and $861.91 for labor.

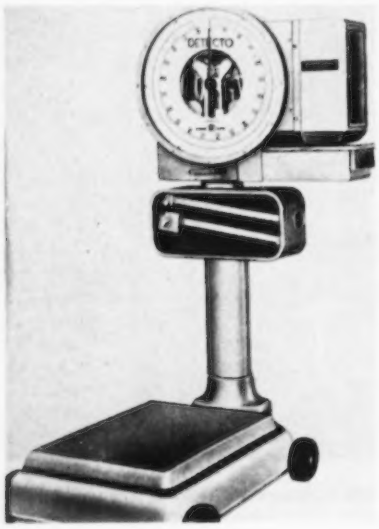
In planning an irrigation program for sulphite waste liquor, there are seceveral problems peculiar to this waste which should not be overlooked. An attempt should be made to neutralize the waste prior to discharge to the irrigation field, and the combined waste should not have a pH less than 4.0, and preferably not less than 5.0. The sulphite liquor should be diluted with white water or river water to a strength not exceeding 2,000 p.p.m. B.O.D. If the wastes are too strong an accumulation of organic matter with occur with subsequent souring and clogging of the soil. The waste should also be free of SO_2 to prevent scalding of plants, and the plants grown on the irrigated plots should have an optimum pH similar to the pH of the waste water.

The probability of contaminating ground water exists and must be considered in all cases. The proximity of wells, direction and rate of ground water flow, and sub-soil structure are several elements that should be considered.

Conclusions

In conclusion, the methods discussed show that considerable progress has been made in the Northwest in decreasing sulphite pollution. These methods, however, are limited and as yet there is no general solution to the problem. The solution for a number of years will undoubtedly be the summation of a great number of individual methods.

NEW EQUIPMENT AND SUPPLIES



Load Scale With Automatic Weight Printer

The Detecto Weight Printer Scale, which automatically prints load weights on tape or ticket, is being manufactured by Detecto Scales, Inc., 549 Park Ave., Brooklyn, N. Y.

Scales of this type are available in five style series, and they can be installed with portable platform, as shown above, or with dormant platform, or as bench, overhead track, overhead suspension, or crane types. Capacities of these scales range from 100 pounds in 1/10-pound units to 50,000 pounds in 50-pound units.

The printing mechanism is said to greatly facilitate accurate record keeping. According to the maker, if through inadvertance or accident, the weight printer is loaded beyond the full capacity of the dial chart, the scale will weigh and print accurately up to the equivalent of 19 gradations beyond the last chart gradation. An exclusive, patented feature of hinged selector fingers is said to prevent damage to the fingers and printing discs should the printer be operated while a load is moving onto the scale.

Standard service is on 110-volt, 60-cycle, single phase, a.c. current, but operation can be furnished for other current characteristics. Portable type scales can be fitted for battery operation.

The printer is obtainable with a device for identifying loads and their weights by means of numerals, letters, prints one original and three copies and is adjustable to numerous ticket sizes.

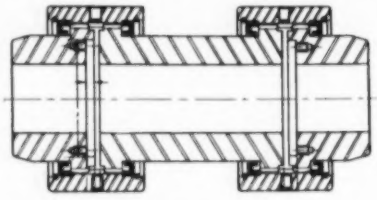
Static Pressure Control

Cat. 101 P Sensitive Static Pressure Control is an improved control unit made by Henry G. Dietz Co., 12 Astoria Blvd., Long Island City 2, N. Y.

The device employs a silicone impregnated glass cloth diaphragm designed to permit operation of the unit at high or low temperatures over long periods of time.

The control is especially applicable on very low pressures where regulation is required in inches of water. A few of the applications are control of static pressure in discharge duct of a fan, of overfire draft in a combustion chamber, and of signal or safety devices for pressure.

Units are of small physical size, obtainable in standard ratings ranging from 0″ to 20″ of water pressure with range adjustment and with fixed differentials from .2″ to 2″ water. Electrical ratings are approved by Underwriter's Laboratories for 10 amperes 125 V or 5 amperes 250 V. A. C. Installation is said to be simple, requiring only one hole to mount on a vertical wall or duct.



Quick-Disconnecting Spacer Type Coupling

The Sier-Bath Spacer Type Gear Coupling, said to be capable of disconnection in a matter of seconds without wrenches or special tools, has been announced by Sier-Bath Gear and Pump Co., Inc., 9252 Hudson Blvd., North Bergen, N. J.

The coupling allows removal of the hubs from either shaft without disturbing the mountings of the connected units, much in the manner of conventional flange and bolt spacer types. But the manufacturer of this coupling claims its simple method of closure greatly reduces the time required for the operation.

Its design provides flexible hubs and a center unit, or "spacer," with teeth at either end, so cut that they mate with each sleeve in a spline fit. The connections have no angular or off-set flexibility, but they allow for end-float.

Couplings are available in stock sizes from 7/8 to 3 for horsepower capacities from 4 to 80 per 100 r.p.m. Stock spacer lengths range from 4 3/8 to 37/8 inches. Other sizes and lengths can be obtained on special order.

Digester Valves With Stainless-Steel Plunger

To reduce corrosion and wear in pulp digester valves, Yarnall-Waring Co., Philadelphia 18, Pa., is offering its Yarway Seatless Digester Valves equipped with a new stainless steel plunger material.

The material is 17/4 PH stainless steel, a precipitation hardening type, with corrosion resistant properties said to approach those of the austenitic (chrome nickel) stainless steel. It has a hardness of 400 Brinell.

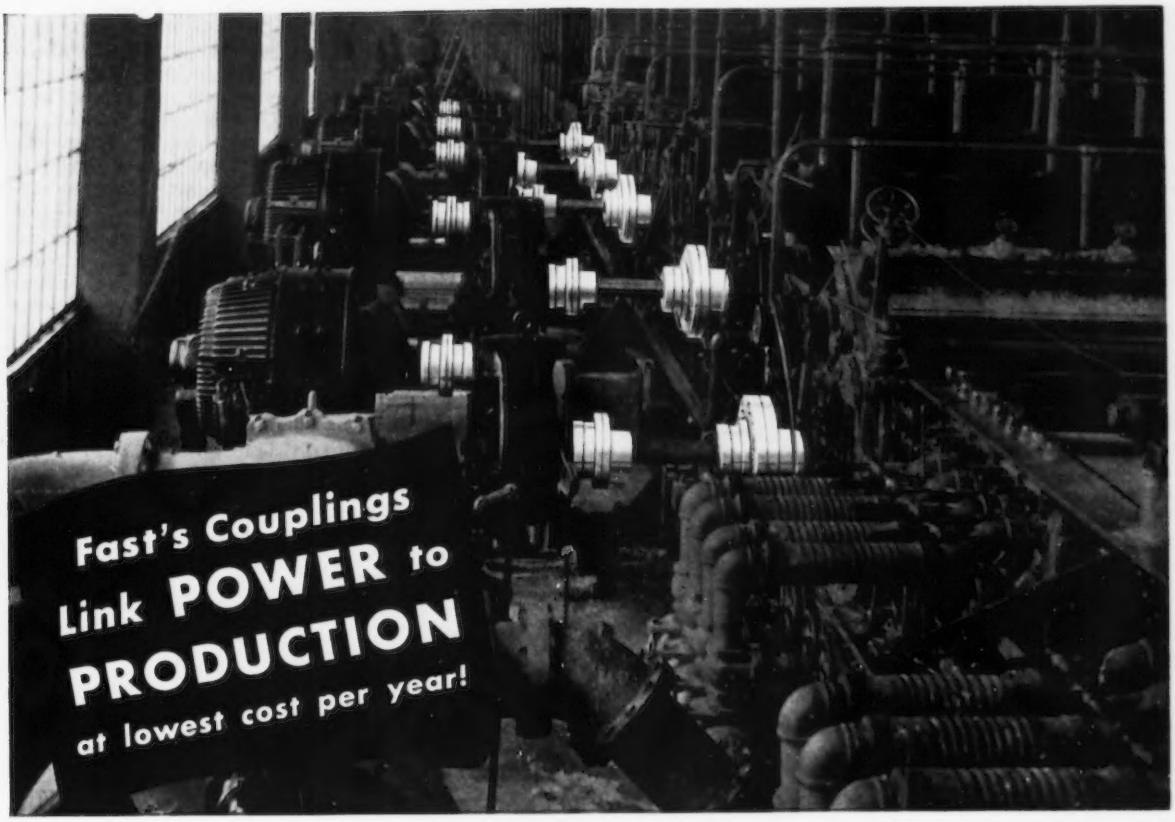
The manufacturer offers as an example of increased valve plunger life, a 17/4 PH plunger removed from an 8″ digester valve in a Florida pulp mill. After 21 month's service, the plunger was perfect from end to end, completely unscratched or scored.

Plungers of this material are available in 6″, 8″, and 10″ seatless digester blow valves. Bulletin B-441 can be obtained from the makers.

Cut-Out Switch For Instrument Circuits

Faster, safer instrument servicing of strip chart Tel-O-Set recorders is now claimed possible through the installation of an automatic motor cut-out switch, known as Mercury Toggle Switch SPST, developed by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.

The manufacturers state that through the action of this switch, the live power line to the chart motor of a recorder is instantly de-energized when



Over half a million FAST'S Couplings now in use!

THROUGHOUT the paper industry, Fast's are recognized as the most dependable couplings on the market! Year in, year out, Fast's continue to *outlast the equipment they connect* . . . saving paper mills time, maintenance and money by eliminating costly coupling failures.

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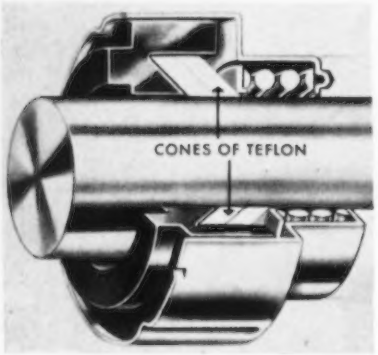
the chassis is withdrawn beyond the safety catch, and further, that there is no danger of accidentally shorting disconnected leads dangling against the instrument case. The device is offered to eliminate need for explosion-proof switches and the necessity for shutting down an entire panel, or for taping "hot" wires.

The switch is glass enclosed and mounted on an angle plate near the cut-out in the top, right side of the recorder case. Power connections for the chart motor are made to a three-point terminal block on the same plate. Without disturbing the quick-disconnect switch, the recorder's drawer-type chassis may be partially withdrawn and held in this position for convenient chart-changing and adjustment. A special safety catch is provided to make this feasible. If the chassis is pulled out beyond the safety catch, it moves a lever, thus tripping the mercury toggle switch and instantly de-energizing the live lead to the chart motor. Without further precaution, the chassis can be safely disconnected and completely removed for servicing. There is no possibility of accidentally energizing the motor circuit during the removal, it is said. Once tripped, the spring-loaded switch remains in the "off" position until the chassis is again partially replaced.

Now available as special optional equipment, the switch will be in production as a standard product later in 1953.

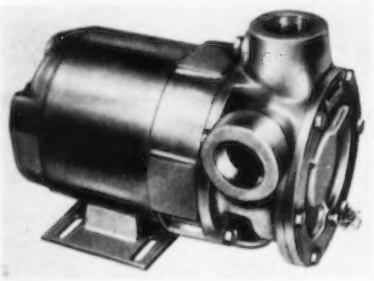


Packaged-Type Mechanical Shaft Seal

A new mechanical seal has been announced by the Crane Packing Co., 1800 Cuyler Ave., Chicago 13, Ill. Known as the "John Crane" Type 19, the seal is said to provide lifetime performance in small pumps, hot water circulators, and many other rotary shaft applications.

Special beveled cones made of Teflon (Du Pont trademark for tetrafluoroethylene resin) are utilized as the flexible member. These cones adapt the seal for services involving water, oil, corrosives or acids; temperatures from —100° to +450°F.; vacuums and pressures to 200 p.s.i.; and high shaft speeds, it is claimed.

Being a packaged type unit, this seal is said to provide quick and easy installation for production assembly and replacement service. It is presently available in sizes to fit shaft diameters of ¼, ⅜, ½, ⅝ and ¾ inches. The metallurgy of the seal, bronze, stainless steel, etc., can be specified to meet service requirements or operating conditions.



Close-Coupled Turbine-Type Pumps

A new line, known as Apco V-Type Close-Coupled Turbine-Type Pumps, is now being offered by Aurora Pump Co., 13 Loucks St., Aurora, Ill.

These pumps are supplied with mechanical seals and have capacities from 3 to 30 gallons per minute and heads from 0 to 250 feet. When desired, they can be furnished with self-priming features.

Their close-coupled design reduces the pump-motor assembly to small size. And because pump and motor shaft are integral, coupling noise and misalignment are said to be reduced. Four different positions for suction and discharge connections make for installation flexibility.

The pump's cover, innerring, and impeller are the only wearing parts and these are made of bronze to resist corrosion.

The pumps have a suction lift of 28 feet at sea level, with reduced capacities beyond 22 feet. It is claimed that the pumps will not vapor bind, being designed to handle entrapped vapor without losing prime.

Small Meter For Low Flow Ranges

The SK Purge Rotameter has been announced by Schutte Koerting Co., Cornwells Heights, Bucks County, Pa. This Rotameter is designed for use where small, low-cost flow meters are needed to indicate and manually control small flows of fluids with good reproducibility but moderate actual measuring accuracy.

Typical applications include the indication of: flow of supply air in bubbler type liquid level measuring installations; flow of purge fluid, generally water or air, in the pipelines connecting orifices, venturi tubes, or nozzles to differential head flow meters; flow of transparent purge fluid to sight glass indicators measuring the flow of opaque fluids; flow of purge fluid to indicator extensions or to extension wells with electric or pneumatic transmitters where the process fluid carries slurries, tends to settle out crystals, or may form surface coattings; flow of sample fluid to measuring installations for continuous chemical analysis of fluids.

The units are small size variable area type flow meters for low flow ranges. The rate of flow of the fluid passing through the meter is indicated by the position of a ball float moving in the tapered glass meter tube vertically installed in the meter. The rate of flow is read in reference to the center of the ball float on a scale mounted alongside of the meter tube.

A back flow check valve prevents back flow of process fluid into the purged apparatus if the pressure of the process fluid should exceed that of the purge fluid or if the meter tube is removed from the meter body.

The meters must be installed in a vertical position. They can be installed directly in pipelines, on instrument panels or in instrument cases.

Portable Static Detector

For the detection of electrostatic charges and electrostatic induction, Specialties, Inc., Skunks Misery Rd., Syosset, N. Y., is offering the Electrostatic Locator, Type D.

The instrument is portable, weighs less than 4 pounds, and contains its own source of power. It is said to be extremely sensitive, with provision made to permit reduction of sensitivity to one tenth or one one-hundredth. Full sensitivity is employed for general area inspection, and the lesser sensitivities permit close examination without deflecting the meter needle off-scale. Scale of meter indicates the amount of charge.

Battery units, supplying the power, are accessible for replacement by re-

moving the rear cover plate. Operation is said to be very simple are requiring no technical training.

Regular use of the detector is recommended by the maker to reduce the fire hazard and production log in a variety of sheet material processing.

OBITUARIES

James Holmes Madden, 41, vice-president and director of the Jay Madden Corp., 10 Rockefeller Plaza, New York, paper mill agency, died on February 14 in Greenwich, Conn., after a brief illness.

John J. O'Connor, 86, superintendent of the Mohawk Paper Mills, Cohoes, N. Y., until his retirement about two years ago, and long identified with executive positions in the paper industry in the United States and Canada, died at his home in Cohoes, February 14. Mr. O'Connor also served a few years as secretary-treasurer of the Paper Makers' Union at Watertown.

He was born in Holyoke, Mass., October 15, 1867. He started work in the paper mills there as a lad and learned the trade from the bottom up. After working in mills there he went with the Babbitt Paper Co., Bellows Falls, Vt., for 11 years, and then with the Paper Makers' Union in Watertown which has present headquarters in Albany. Later positions were with the Don Valley Paper Co., Toronto; the Howard Smith Paper Mills, Beau Harnois, Quebec; and International Paper Co., Niagara Falls.

Eilif Bang recently head of the Manufacturers Assn. of Norway, and president of the Tofte Pulp Mill near Oslo, died early this month. He had been shipping pulp to the United States for a great many years. He was well-known and highly esteemed by most of the nonintegrated paper mills in America. He was a straightforward business man respected by all who knew him.

Charles R. McMillen, 73, former president of the Union Bag and Paper Corp., died February 2 at Orange, N. J.

Mr. McMillen left Union in 1931 to become executive vice-president and director of the St. Regis Paper Co. He remained with St. Regis until 1938 when he joined the Camp Manufacturing Co. of Virginia. He retired from Camp in 1949 and returned to Union in a consulting capacity, a post he retained until his death.

NEW LITERATURE

Atkomatic High Pressure Valves. (Bulletin) Contains nomenclature sectional drawing of Type HP electrically operated valve with pressures to 3000 p.s.i.; schematics of normally closed and open operations; application information and dimensions. Atkomatic Valve Co., Dept. 171, 545 Abbott street, Indianapolis 25, Ind.

Boiler Control. (Bulletin 1007) Describes and illustrates the new Copes-Vulcan Boiler Control with instrumentation by Taylor; includes combustion, boiler steam temperature, soot blower, feed water controls; also standard or miniature instruments and various panels. Copes-Vulcan Div., Continental Foundry & Machine Co.

D-I Lestoil—A Solution to Your Raw Stock Problems. (Brief) Discusses what it is; how to use it; results obtained; particularly when used by paper mills for removal from raw stock of ink, grease, oil, adhesives, etc. Adell Chemical Co., 176 Race street, Holyoke, Mass.

Foxboro Circular Case Controller. (Bulletin 465) Contains illustrations of restyled instrument to automatically control temperature, pressure, liquid level, humidity, other process variables; installation diagrams; instrument components and their individual functions; also, two-page data section analysis of four classes of measuring systems. Foxboro Co., 36 Neponset Avenue, Foxboro, Mass.

Fluorescent Commercial and Industrial Luminaires. (Catalogue B-5799) Provides photographs and diagrams of each type; where best applied; models available; features and dimensions; also data table. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

Howe Four Section Straight Lever Motor Truck Scales. (Bulletin 678) Contains illustrated sales copy and specifications. Howe Scale Co., Rutland, Vt.

Rodney Hunt Engineered Stainless Steel Equipment. (Bulletin 153) Provides photographs and legends suggesting the range of stainless steel products fabricated; also data sheet for requesting quotations. Rodney Hunt Machine Co., 53 Mill street, Orange, Mass.

Lunkenheimer 125 Lb. S.P. Bronze Globe Valves. (Circular 582) Features sectional views of pressure globe, angle and check valves equipped with Lunkenheimer's "Non-Slip" handwheel and exclusive "Stemalloy" stem; also tables of dimensions. Lunkenheimer Co., Box 360U, Cincinnati 14, Ohio.

Metron Tachometers. (Technical Data Sheet 81M) Describes Series 81M speed recorders, single range; strip chart; inkless; panel mounting. Also includes tables of recorder speed range markings and selection of units other than r.p.m. Metron Instrument Co., 432 Lincoln street, Denver 9, Colo.

Penfield MAC Models — Fully Automatic, Mono-Column Demineralizers. (Catalogue Sheet) Provides photograph and schematic; also detailed description of parts, specifications and performance data. Penfield Mfg. Co., Inc., 19 High School Avenue, Meriden, Conn.

Rapistan Floor-Veyor Heavy Duty Power Belt Conveyor. (Bulletin FV-53) Contains technical data, specifications, chart and tables show recommended installation procedures each part of the unit. Rapids-Standard Co., Inc., 342 Rapistan Bldg., Dept. FV-53, Grand Rapids 2, Mich.

Silicate P's & Q's. (Volume 33, February, 1953) A Message to Those Who Use Silicates of Soda . . . or Could Use Them. Deals with a new procedure for deinking and bleaching used paper from a patented process, based on the use of peroxide and sodium silicate, which has proved successful. Philadelphia Quartz Co., Public Ledger Bldg., Independence Square, Philadelphia 6, Pa.

What You Should Know About Diesel Engines. Describes in non-technical language its invention and early development; explains its operation in simple pictures and words; also latest advancements in design. P&H Diesel Div., Harnischfeger Corp., Crystal Lake, Ill.

Photograph Above Was Taken at the Association of Pulp Consumers, Inc., Luncheon Held During 1953 "Paper Week"

PRICES

The prices below reflect market quotations in New York at the mill level on standard grades. Does not include spot offerings.

PAPER AND BOARD

Standard News, Delivered Ports

Rolls, contract, per ton	$121.00/$126.00
Sheets	138.00/ 147.50

Zone 1, f.o.b. mills, c.l. frt. allowance

Kraft—per cwt. 50# base wgt.

Standard Wrapping, ctr. rolls	$7.75/ —
Butchers, counter rolls	8.25/ —
Standard Bag, mill rolls	7.50/ —

Tissues—per ream 24x36 (480) 10 lbs. 2500 lbs.

Wh. No. 1 Frd.	$1.85/$1.90
Wh. No. 1 MG	1.85/ 1.90
Wh. No. 1½	1.50/ 1.65
Wh. No. 2	1.35/ 1.45
Kraft Anti-Tar 20-30	1.75/ 1.80
White Anti-Tar 20-30	2.20/ —

Toilet—per case of 100 rolls—1M sheets

Unbleached 4½x4½	$8.00/$8.25
Unbleached 4½x5, 650 sheets	6.65/ —
Bleached 4½x4½	10.00/12.50
Bleached 4½x5	9.81/10.14
Per Case of 50 rolls—2000 sheets	
Unbleached 4½x4½	$8.00/$9.75
Bleached 4½x4½	6.95/ —
Per Case of 100 rolls—1000 sheets	
Facial, 4½x4½, 2 ply	$8.95/10.37
4½x5, 2 ply	10.25/10.75

Paper Towels—per case of 3750

Wh. Jr. M'tif'd 9⅛x9⅛	$6.40
Br. Sr. M'tif'd 9⅞x12	4.40
Br. Jr. M'tif'd 9⅛x9⅞	3.90
Br. Jr. Sgl. fold 9⅞x10¾	3.95
C-Fold 10⅛ min. x 14 max.	5.90/ 6.64
Blchd. 7½x11, 48/50 rolls	6.80/ 7.92

Manila, per cwt.

	Sheets
No. 1 Jute Tag, 100-lb., base price	$20.05/ —
Reg. Jute M.F. 40-lb., base price	19.50/ —
Printing Manila	11.50/ —

Gummed Tape—per bdl., 500 bdls. or more

90-lb. 375 ft. GSI	‡ $7.20/ —
60-lb. 600 ft. GSI	‡ 7.20/ —
35-lb. 800 ft. GSI	‡ 8.21/ —
35-lb. 500 ft. GSO	‡ 6.21/ —

MARKET WOOD PULP

First Quarter Contract Prices, Per Short Air-Dry Ton

	Delivered Basis		Varying Freight Allowances		
	U. S.	Canadian	Swedish	Finnish	Norwegian
Groundwood	$82.50/ 87.50†	‡$60.00/ 90.00	$75.00/ 80.00§	$75.00/ — §	$80.00/ —
Sulfate, Bleached	140.00/147.50	145.00/155.00	140.00/142.50§		
Semi-bleached Sulfate	140.00/ —		135.00/ —		
Sulfate, Unbl.	95.00/125.00	100.00/125.00	$100.00/105.00§	$105.00/135.00	100.00/ — §
Sulfite, Blchd.	140.00/ —	140.00/145.00	$137.50/140.00	140.00/ —	140.00/145.00
Sulfite, Unblchd.	125.00/132.50	130.00/135.00	115.00/ — §	120.00/125.00	115.00/ — §
Sulfite, Unbl'd (glassine)	127.00/ —		119.00/ — §		
Soda, Blchd.	140.00/ —	140.00/ —		Delivered Basis	
Sulfite Screenings	45.00/ —				
Stand. News, Sideruns	92.50/ —	80.00/ 85.00			

† Midwestern Markets. ‡ F.o.b. Shipping Point. § On Dock Atlantic Ports.

Boards Deld., per ton (10 tons or over)

Filled News	‡ $82.50/ —
Plain Chip	‡ 70.00/ 80.00
Blchd. Mla. Ld. Chip	140.00/ —
White Pat. coated .020	160.00/ —
Kr. Liner 42 lb.	117.50/ —
Kr. Corr. .009	122.50/ —
Binders Boards	133.00/ —

The following prices are representative distributors' resale prices:

Rag Content Bonds and Ledgers

White, 20 lb.

Bonds	4 Ctns.
	per cwt.
100% Rag. Ex. No. 1	$70.45/$75.90
100% Rag	62.65/ —
75% Rag	48.15/ —
50% Rag	38.90/ —
25% Rag	31.65/ 33.00

Ledgers	4 Ctns.
	per cwt.
100% Rag Ex. No. 1	$72.65/$72.80
100% Rag	63.90/ —
75% Rag	49.40/ —
50% Rag	40.20/ —
25% Rag	33.00/ 34.30

Sulphite Bonds and Ledgers

White, 20 lb.

Bonds	4 Ctns.
	per cwt.
Watermarked	$19.00/$20.50
Plain	18.40/ 19.50

Ledgers	4 Ctns.
	per cwt.
Watermarked	$20.30/$21.80
Plain	19.35/ 20.80

White Book

Conversion Coated	Case
	per cwt.
No. 1	$23.90/$24.65
No. 2	22.40/ 22.85
Machine Coated	
Extra No. 1	$21.35/$21.65
No. 1	19.15/ 19.65
No. 2	16.65/ 17.40
Uncoated	
No. 1 Antique (Watermarked)	$19.15/$19.65
Offset	18.15/ 19.15
A Grade E. F.	18.40/ 18.65
A Grade S. C.	18.90/ 19.15
B Grade E. F.	17.40/ 18.15
B Grade S. C.	17.90/ 18.65

‡ Indicates a price change.

WASTE PAPER MARKET

Prices to mills, per ton, f.o.b. cars shipping point (includes brokers' fee.) These quotations are a partial indication of the price range on volume tonnage in each market on the date specified, as gathered from major dealers. SPECIAL PACKINGS AND SPOT TONNAGE NOT INCLUDED. See TRENDS.

	New York Feb. 24	Philadelphia Feb. 16	Boston Feb. 20	Chicago Feb. 9
No. 1 Mixed Paper	$9.00/ 10.00	$8.00/ 11.00	$9.00/ 10.00	$8.00/ —
No. 1 News	14.00/ 15.00	11.00/ 15.00	15.00/ 18.00	17.00/ —
Over-issue News	21.00/ 23.00	18.00/ 20.00	20.00/ 23.00	20.00/ —
Mill Wrappers	14.00/ 15.00	8.00/ 10.00	12.00/ 15.00	11.00/ —
Old Corrugated	17.00/ 18.00	15.00/ 17.00	18.50/ 19.00	20.00/ —
Double Kraft Ld. Corr. Cuts	31.00/ 40.00	30.00/ 40.00	35.00/ 40.00	35.00/ 40.00
100% Kraft Corr. Cuts	45.00/ 55.00	45.00/ 55.00	40.00/ 55.00	50.00/ —
Used Sugar & Flour Bags	35.00/ 45.00	28.00/ 32.50	35.00/ 45.00	35.00/ —
Triple Sorted Br. Kraft	40.00/ 45.00	30.00/ 35.00	35.00/ 50.00	35.00/ —
New Br. Kraft Env. Cuts	65.00/ 75.00	55.00/ 65.00	55.00/ 70.00	50.00/ —
New Br. Kraft Bag Cuts	55.00/ 60.00	45.00/ 55.00	50.00/ 55.00	50.00/ —
No. 1 Gdwd. Shvs.	20.00/ 30.00	15.00/ 20.00	25.00/ 35.00	27.00/ —
White Newsblanks	55.00/ 70.00	60.00/ 70.00	50.00/ 65.00	50.00/ —
No. 1 Flyleaf Shvs.	25.00/ 35.00	25.00/ 35.00	30.00/ 45.00	30.00/ —
No. 1 Soft Wht. Shvs.	65.00/ 75.00	55.00/ 75.00	70.00/ 80.00	55.00/ —
Super Soft Wht. Shvs.	85.00/ 95.00	65.00/ 80.00	80.00/ 90.00	75.00/ —
Hd. Wht. Shvs.	95.00/100.00	85.00/100.00	90.00/100.00	90.00/ —
Hd. Wht. Env. Cuts	115.00/125.00	100.00/125.00	105.00/125.00	100.00/ —
New Manila Env. Cuts	65.00/ 72.00	65.00/ 80.00	70.00/ 80.00	40.00/ —
Col. Tab. Cards	45.00/ 60.00	50.00/ 55.00	40.00/ 50.00	45.00/ —
Manila Tab. Cards	70.00/ 80.00	70.00/ 85.00	70.00/ 80.00	60.00/ —
Mixed Ledger	35.00/ 47.50	35.00/ 45.00	38.00/ 45.00	45.00/ —
White Ledger	52.50/ 57.50	55.00/ 60.00	53.00/ 65.00	60.00/ —
No. 1 Book & Mag.†	16.00/ 18.00	13.00/ 15.00	15.00/ 16.00	15.00/ —
No. 1 Rep'd. Hvy. Books‡	26.00/ 35.00	18.00/ 22.50	25.00/ 35.00	27.50/ —

† Includes Time & Life; no coarse groundwood. ‡ Not to exceed 10% groundwood. § Deld.

RAG MARKET

New Domestic Cotton Cuttings

Delivered Mill Basis

No. 1 White Shirts	$14.50/$15.00
No. 1 Unblchd. Muslins	16.00/ 16.50
Blchd. & Unblchd. Underwears	16.00/ 16.50
Blchd. Canton Flannels	14.50/ 15.00
No. 1 Light Sileasias	12.25/ 12.75
No. 1 Light Prints	8.00/ 8.25
No. 1 Blue Overalls	9.50/ 10.00
Suntan Khakis	7.75/ 8.25
Fancy Shirts	7.25/ 7.50
Indigo Blues	7.00/ 7.25
Mixed Khakis	5.25/ 5.75
Corduroys	4.75/ 5.00
Cottonades	4.75/ 5.00
No. 1 Washables	4.25/ 4.50

Old Domestic Cotton Rags

(Prices to Dealers, F.o.b. Ship. Pt.)

	Per 100 lbs.
Mixed White	$3.50/$4.50
Cotton Pants & Overalls	2.75/ 3.00
Thirds and Blues, Repacked	2.00/ 2.25
No. 1 Roofing Rags	1.00/ 1.05
No. 2 Roofing Rags	.90/ .95

Bagging

(Prices to Dealers, F.o.b. N. Y.)

	Per 100 lbs.
Foreign Gunny	$4.75/$5.00
Heavy Wool Tares	4.75/ 5.00
Foreign Scrap Burlap	3.75/ 4.00
Austr. Wool Pouches	5.00/ 5.50
Domestic Manila Rope	6.25/ 6.75
No. 1 Sisal Strings	5.00/ 5.25

COTTON LINTERS

Memphis Market

F.o.b. Oilmills

	Feb. 17 cents per lb.
Grade 2	13.50/ 12.00
3 1st cut	11.50/ 10.00
4	9.00/ 7.00
5	6.50/ 5.00
6 2nd cut	4.00/ 3.75
7	3.50/ 3.50

PRICES OF MATERIALS

Aluminum sulfate:		
cml. bags, wks. cwt.	1.65	
iron-free, c.l. cwt.	3.25	
Casein, acid prec.:		
dom. sh. pt. c.l. lb.	.28	/ .40
imp. ex. dock lb.	15¼	/ .23½
Caustic soda:		
c.l. wks. solid, 76% cwt.	3.35	
flak. & grd. 400 lb. drums	3.75	
liquid 50% tanks	2.55	
liquid 70% tanks	2.65	
China clay:		
dom. air-float, c.l. wks. ton	10.00	
water-washed, lump, filler	11.00	
coating	17.60	/30.50
imported, ex. whse. short ton	15.20	/28.35
Chlorine:		
single-unit tanks, works cwt.	2.70	
multi-unit cwt.	3.20	/ 4.40
Formaldehyde:		
USP, imb. drms. c.l. wks. lb.	.0666	/ —
L.c.l., E. wks.	.071	/ —
Fuel oil:		
Bunker C, No. 6 hvy. tanks, N.Y. harbor bbl.	2.00	/ —
light, tanks, refinery bbl.	2.15	/ 2.25
Lime:		
hydrated, bags, wks. tons	13.50	/15.50
Gum rosin:		
K, M, N drms, c.l. Savan cwt.	7.48	/ 7.55
Rosin size:		
70%, gum & pale grds., tank cars, south, sh. pt. cwt.	6.50	/ 6.60
Salt cake:		
dom. bulk, c.l. wks. ton	17.00	
wks. frt. all. ton	20.00	/22.00
Soda ash:		
light, 58%, bags, wks.	1.50	
bulk cwt.	1.20	
Sodium silicate, 40° Be.:		
tank-cars, wks. cwt.	.90	/ —
drums, wks. cwt.	1.25	/ 1.80
42° Be. WW, tank-cars, wks. cwt.	1.45	/ —
drms, wks. cwt.	1.80	/ 2.35
Sodium peroxide:		
dms. c.l. E. of Miss. lb.	.186	
l.c.l. do. lb.	.196	/ —
Soybean, protein:		
chem. isol, wks., c.l., bags lb.	.23½	/ .24¼
Sulphuric acid:		
60° Be. cbys. c.l. wks. cwt.	1.75	/ —
l.c.l. wks. cwt.	2.05	/ 2.85
tankcars, wks.	16.30	/ —
Sulphur:		
crude, c.l. mines, contract, long ton	21.00	/22.00
f.o.b. vessels Gulf	25.00	/27.50
Sulphur dioxide:		
liquid, coml. cyl. wks. lb.	.09	
multi-unit cars lb.	.0535	
Starches:		
pearl corn, bags, c.l. prod. plant	6.39	/ —
white, dextrines, c.l. do. cwt.	7.78	/ —
potato, Idaho, c.l. wks. cwt.	8.50	/ —
potato, Maine, f.o.b. wks. cwt.	7.50	/ —
potato, imported O.D. bags	8.60	/ —
Talc:		
domestic, sacks, c.l. wks. ton	25.00	/30.00
Titanium dioxide:		
anastase, c.l. deld., bags lb.	.21	/ .21½
l.c.l. deld. lb.	.22	/ .22½
rutile, c.l. deld. lb.	.23	/ .23½
l.c.l. deld. lb.	.24	/ .24½

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Ohio TAPPI Hears Curtis

Two hundred and thirty members and guests of the Ohio Section heard Francis J. Curtis, vice-president and director of Monsanto Chemical Co. talk on "More and Better Research" on February 10 at the Hotel Manchester in Middletown, Ohio.

The next meeting of the Section is scheduled for March 10 at 8:00 p.m. at the Hotel Manchester. It will be preceded by dinner at 6:45. The speaker will be Dr. J. Edward Todd of the Institute of Paper Chemistry, Appleton, Wis. His subject will be "Selection of Technical Personnel."

Eighth Instrument Show Is Largest Held

The Eighth National Instrument Exhibit, which will be held at the Sherman Hotel in Chicago, September 21-25, will be the largest instrument show ever held, according to Richard Rimbach, exhibit manager.

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AMERICAN PAPER AND PULP ASSOCIATION'S PAPER PRODUCTION RATIO REPORT

(Production as per cent of normal capacity)

COMPARATIVE WEEKLY SUMMARIES

	Jan. 17	Jan. 24	Jan. 31	Feb. 7	Feb. 14
1953	94.7	94.3	96.0	94.8r	95.9
	Jan. 19	Jan. 26	Feb. 2	Feb. 9	Feb. 16
1952	99.0	99.0	97.7	99.3	97.9

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1952	97.1	97.8	95.1	90.4	87.9	97.6	73.3	86.1	82.5‡	90.9‡	90.5‡	85.6‡	89.6‡
1953	95.0‡												

COMPARATIVE YEARLY SUMMARIES

	1946	1947	1948	1949	1950	1951	1952	1953
Year to Date	95.6	104.7	100.4	94.5	93.9	100.0	97.8	95.2
Year Average	96.9	101.7	92.1	83.7	95.8	98.0	89.6‡	

‡ Preliminary
r Revised.

PAPERBOARD OPERATING RATIOS†

	Jan. 17	Jan. 24	Jan. 31	Feb. 7	Feb. 14
1953	95	94	94	94	95
	Jan. 19	Jan. 26	Feb. 2	Feb. 9	Feb. 16
1952	85	85	85	85	87

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1952	81	86	85	82	82	82	71	89	88	96	96	85	85
1953	91												

All of the above data is based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

Note: In the above tables *all* the ratios shown are on the basis of a normal 6 and 7 day capacity.

† Per cents of operation based on "Inch-Hours" reported on a 6-day basis to the National Paperboard Association.

TAPPI Meeting Dates

DATE	SECTION	PLACE
March 6	Central District Empire State	University Club, 431 E. Fayette St., Syracuse, N. Y.
March 10	Lakes States	Northland Hotel Green Bay, Wis.
March 10	Ohio	Manchester Hotel Middletown, Ohio
March 12	Empire State Northern District	Hotel Woodruff Watertown, N. Y.
March 13	Pacific	Longview, Wash.
March 19	Kalamazoo Valley	Hotel Harris Kalamazoo, Mich.
March 19	Empire State	Milfranks Restaurant Glens Falls, N. Y.
March 20	New England	Hotel Roger Smith Holyoke, Mass.
March 20	Lake Erie	Carter Hotel Cleveland, Ohio
March 26	Miami Valley Division	American Legion Hall Middletown, Ohio
May 21-23	Joint TAPPI-Superintendents Meeting, Pacific Section	Gearhart Hotel, Gearhart, Ore.
June 5	Empire State Section Joint Meeting	Syracuse, N. Y.
June 5	Miami Valley Division Central District	Spring Jamboree Piqua, Ohio
June 19 and 20	New England and Maine-New Hampshire	Poland Spring House Poland Spring, Maine

Superintendents Meeting Dates

DATE	DIVISION	PLACE
March 19	Michigan	Hotel Harris Kalamazoo, Mich.
March 26	Miami Valley	American Legion Hall Middletown, Ohio
May 8-9	Northwestern	Del View Hotel Lake Delton, Wis.
May 15-16	Pennsylvania-New Jersey-Delaware	Stacy-Trent Hotel Trenton, N. J.
May 22-23	Pacific Coast Joint Meeting With TAPPI	Gearhart Hotel, Gearhart, Ore.
June 9-11	National	Atlanta-Biltmore Hotel Atlanta, Ga.
Sept. 17-19	New York-Canadian	The Alpine Inn St. Marguerite, Que.
Sept. 17-19	Northeastern	Poland Spring House Poland Spring, Maine
October 28-30	Southern and Southeastern (Joint Meeting)	Edgewater Gulf Hotel Edgewater Park Mississippi

FOR SALE

CAMERON SLITTERS

1—50" and 1—60" Type 26-3A Duplex.
1—52" Model 28-3D Duplex.
1—42" Type 26-2A.
1—42" and 1—60" Type 6.
1—52" Type 10—5A.
4—62" Type 40-1-AF.
1—62" Type 10-5.
2—72" Type 10-11, 1—Shear and 1—Score cut.

OTHER SLITTERS

1—90" KIDDER Shear Cut Super-Speed, Junior Model.
1—60" Kidder, Model SH, Shear-cut, 40" rewind.
1—48" Kidder Model CH Shear-cut.
1—48" Inman, Shear-cut, for Board 48" Rewind.
1—40" and 1—60" Langston, Type A, Shear-cut.
1—30" and 1—40" Kidder Model SL Shear-cut.
1—30" and 1—40" Model B Fales, Shear cut

POWER PAPER CUTTERS

11—Seybold, 44" "Sixty" Auto-space, 56" 10Z, 44", 56" and 64" 6Z, 39" and 44" 20th Century, 57" Dayton, 44", 48" and 55" Holyoke.
4—Oswegos, 38", 44", 50" and 63".
3—Smith & Winchester Undercut, 63", 69" and 84".

PRINTING PRESSES

1—42" Kidder 6 color ANILINER, VS Drive. Roll to roll.
1 14" 5-color Champlain Unit Type Rotogravure Press.
1—52" 3-color Manhasset Aniline Press with Water cooled rewinder, slitter, dryer and AC V-S Drive.
1—60" Waldron 5 color Press, 3 rotogravure and 2 aniline units.
1—30", 1—32" and 1—40" Aniline Tail-printers.

MISCELLANEOUS MACHINES

1—Seybold 24" x 38" U.A. Model.
3—Sheridans, 18" x 33", 19" x 45" and 22" x 44".
1—14" and one 15" 5 color Champlain, unit type, Rotogravure Presses.
1—26" Waldron Cellophane Embossing Machine.
3—Waldron Embossers. 1—29", 1—42" and 1—32" with Inking Device.
2—81" Dietz Toilet Paper Convertors.
3—Beck Sheeters; 1—30" and 1—36",1—55" with Electric Eyes.
1—72" Squeeze Roll Waxing Machine.
1—48" Mayer Equalizer Waxing Machine.
1—Simplex Bag Machine, Model #7-24.
1—10" x 12" Staude Cellophane Window Machine. AC motor.
1—Weber Satchel Bottom Bag Machine. Range 4¾" x 12" to 10" x 22".
2—Roto Bag Machines. 1—Model C for Cellophane; 1—Model PO-2 for Polyethelene.
1—75" Hamblet Single Rotary Sheet Cutter. With Erie Layboy and 24 Roll Backstands.

PAPER MILL MACHINERY

1—116" Beloit Fourdrinier Wet-end.
1—94" Sandy Hill Fourdrinier Wet-end.
1—88" Beloit Removable Fourdrinier Wet end.
1—62" Norwood 16-roll Stack of Glassine Super Calenders, with Dampener.
1—81" Hudson-Sharp Embossing Machine for Toilet Tissue.
1—72" Waldron Pneumatically operated Brush Coater.
1—1000# Horne Beater. Roll 54" dia. x 60" face.
1—36" Bauer Model EM Double Disc Refiner.
1—Weiner Refiner.
1—7' dia. x 80" face Rice, Barton Yankee Dryer. Complete.
10—12-14 Plate Flat Screens.
1—Beloit Iron Works Suction Couch Roll 25" dia. 104" face.
1—#2 Claflin Refiner. For direct Motor Drive.
1—72" Rogers Dual Press Wet Machine. With Clothing and AC Motor.
1—IMPCO Knotter. Requires 25 HP Motor.

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PAPER TRADE JOURNAL

CLEARING HOUSE

PAPER TRADE JOURNAL

RATES FOR ADVERTISING
(PAYABLE IN ADVANCE)

$.75 cents per line (6 words to line) minimum charge $3.75
—Additional charge of 70 cents if box number is used

Situation wanted advertisements can be repeated for ½ rate

Space in this section can also be purchased at $5.00 per column inch—(1" x 2¼")

Address replies to advertisements appearing under Box Number in care of **PAPER TRADE JOURNAL, 15 West 47th Street, New York 36, N. Y.**

HELP WANTED

MEN WANTED—POSITIONS OPEN

We can place—Manager western mill making bonds, envelope, litho, offset, tissue, including pulp mill and bleaching plant; mgrs., supts and asst. supts. board mills; night supt. Fourdrinier mach. mill (New Eng.); chemists, chem. engineers and laboratory men for mills, also for demonstrating and selling, salary range $3600-$8400 year; supt. rag content papers; supt. light weight tissues and sulphites.

Master mechanics, plant engineers, mech. engineers and assistants, salary range $5,000-$9,600 year; designers and draftsmen; power plant supervisors; finishing foreman sulphite bond papers, also foreman finishing and shipping board mill; laminating foreman; training supervisor; technical service man to cover pulp and paper mills; salesman paper makers' felts Midwest territory; machine tenders and back tenders.

LIST YOUR APPLICATION WITH US.
IT WILL BE CONFIDENTIAL.
CHARLES P. RAYMOND SERVICE, Inc.
Phone: Liberty 2-6547
294 Washington St., Boston 8, Mass.
F-27

Paper mill in the east has opening for paper mill superintendent. Must be graduate engineer or employed as superintendent or assistant superintendent in modern tissue mill. Write own salary if you have the ability. Great opportunity for future. Ideal conditions. In first letter submit complete resume of personal background, education and experience. Address Box 53-78. Care Paper Trade Journal.
F-27

WOODS EXECUTIVE

A new paper mill now under construction requires an executive with broad experience in large scale woods management and operations. Must possess administrative ability and be capable of organizing and directing all phases of a woods program. Experience in pulpwood procurement in Southern States is highly desirable. In addition, should have direct experience in management of pulpwood production activities.

Bowaters Southern Paper Corporation
Calhoun, Tennessee TF

MILL MANAGER

Middle-Aged man having background in tissue and toweling grades to assume full responsibility for Paper Mill and Converting Operations. Must be well qualified in handling help. Good personnel relations is a must. Mill located in Eastern Massachusetts. Address Box 53-38 care Paper Trade Journal. TF

Designers, detailers, layout draftsmen for board work with old established manufacturer of medium and heavy machinery. Men with paper mill machinery experience preferred. Permanent openings, excellent salary and working conditions. Hospital and surgical benefits. Resume covering work, technical history, and salary expectancy required. Address Box 53-68 care Paper Trade Journal. F-27

HELP WANTED

HELP WANTED

Wanted two backtenders, one third hand. Machine running 800 feet. Manufacturing light weight chip.

Call W. A. Crawford collect 3-3441
PRAIRIE STATE PAPER MILLS
JOLIET, ILLINOIS TF

WANTED FOR MONTREAL, CANADA—Converting Machinery adjuster and tender having practical experience and familiarity with Toilet Paper and Napkin producing machinery. Address reply: ASTRA PAPER CO., LTD., 209 Vallee Street, Montreal, Canada. F-27

SITUATIONS WANTED

FOOD WRAPPER & SPECIALTY PRODUCTS ENGINEER

Over 15 yrs. in sulphite mills & paper products development (& production). Includes lab supervisor, 5 yrs. with food wrappers, 5 yrs. in major research lab on specialties & coatings. Some plastics extrusion experience & equipment design. Graduate degree. Under 50. Require substantial increase over $7200 to change. Write, Box 53-65 Paper Trade Journal.
F-27

ENGINEER

Twenty years varied experience in all phases of pulp and paper mill engineering, maintenance, operation, and design. Have practical paper making experience with excellent record for increasing production. Now employed as plant engineer and want position with future.
S.B. degree in engineering. Licensed professional engineer New York State. Address Box 52-484 Care of Paper Trade Journal, 15 West 47th Street, New York 19, N. Y. TF

PAPER COATING MACHINERY MANUFACTURERS — Waxing, Oiling, Carbon Laboratory Coating and Treating and Flat Ream Measuring and Converting Machines. New improvement. THE MAYER MACHINE COMPANY, INC., 1313 Buffalo Road, Rochester, 11, N. Y. TF

SUPERINTENDENT — Twenty six years of practical experience manufacturing high grade folding boxboard, frozen food cartons, other sanitary food packages from sulphite, sulphate, groundwood, old paper stock. Aggressive, capable man. Excellent references. Address Box 53-4 care Paper Trade Journal. M-6

DEINKING, BLEACHING, WASTE PAPER PROBLEMS—Expert consulting services, laboratory facilities, available. Operational problems of existing plants; design of new plants; engineering; construction. In strictest confidence. Address Box 53-19 care Paper Trade Journal. TF

MANAGER—Young Man, currently employed, with 18 years actual experience in all phases of papermaking including manufacturing, sales, costs, production planning and inventory control. Wants position as Manager or Assistant Manager. Address Box 53-82 care Paper Trade Journal. M-6

EXPERIENCED COATED MILL SUPERINTENDENT desires to make change with mill in midwestern state. Has a very good employee relation and production record. Best of references. Address Box 53-79 care Paper Trade Journal. F-27

SITUATIONS WANTED

PLANT MANAGER—Paper and Board and their conversion. Highly successful record in organization; administration; development; labor relations; and high level production. Presently employed. Seeks challenging opportunity. Address Box 53-80 care Paper Trade Journal. M-27

SUPERINTENDENT — A practical paper maker with a proven background on Cylinder Specialties, where quality counts as well as quantity. Possess a technical as well as a practical training. Address Box 53-87 care Paper Trade Journal. M-20

FOR SALE

A.C. MOTORS (3Ph. 60Cy.)

HP	MAKE	TYPE	SPD.	WDG.
400	Al. Ch.		514	S.R.
400	G.E.	MT	450	S.R.
300	G.E.	IM	450	S.R.
200	West.	CW	600	S.R.
150	G.E.	ATI	600	Syn.
125	West.		277	Syn.
100	G.E.	IM	450	S.R.
100	West.		900	Syn.
100	G.E.	IK	1750	S.R.
100	West.	CS	1200	S.C.
75	West.	CS	900	S.C.
60	West.	CW	575	S.R.
30	West.	CS	1750	S.C.

Many Smaller A.C. Motors In Stock

TRANSFORMERS (1Ph. 60Cy.)

KBA	MAKE	PRI.	SEC.
1—8000(3Ph)	G.E.	25000	22900
3—200	Al.Ch.	22000	2200
3—100	West.	13200	2300
3—75	Kuhlman	13200	110/220
5—25	West.	6600	110/220

D.C. MOTORS: M-G SETS, ETC.

MOORHEAD ELECT. MACH'Y. CO.
P.O. Box 7991L — Pittsburgh 16, Pa.
TF

FOR SALE

83" Kamyr wet machine, new 8 ft. Impco double disc cylinder, auxiliary equipment.

72" Rogers double press wet machine cylinder 60" x 72".

84" Carthage wet machine, cylinders 36" x 84".

5 ft. x 8 ft. Impco sludge filter.

10 knife 84" Carthage chipper, 350 HP motor, starting equipment and knife grinder.

Drum barkers 45 ft. long x 49 ft. dia.

Four knife Carthage 88" chipper.

600 lb. Logeman pulp baler.

Impco pulp screen Design No. Four.

2 Impco rotary knotters.

3 Impco rotary pulp screens type 3.

Claflin refiner with 200 HP motor.

Waterville chip crusher.

Appleton horizontal splitter, four ft. wood.

Waterville vertical splitter, 4 ft. wood.

FRANK H. DAVIS CO.
175 Richdale Ave.
Cambridge, Massachusetts
F-27

FOR SALE—One reconditioned 150 HP, 514 RPM open type induction motor, G. E. Type 1K, Frame 16, 440 V, 3 phase, 60 cycle. One G. E. Type R-1034 manual starting compensator NR-5160-N1 for above. Taylor Fibre Co., Norristown, Pa. F-27

TELEPHONE
HUMBOLDT 2-2177

CABLE ADDRESS: JACKROSS

ROSS PAPER MACHINERY CO.

265 PASSAIC STREET
NEWARK 4, N. J.

CONVERTING
PAPER MAKING EQUIPMENT

NEW, USED, REBUILT
PAPER AND PULP MACHINERY

AGITATOR DRIVES
2—Cleveland enclosed—3 h.p. Ratio 24 to 1.
1—Foote Bros. enclosed—15 h.p. Ratio 33 to 1

AIR HOIST
1—5-ton Ingersoll-Rand with Trolley.

BALERS
1—Economy Baler—20¼ x 24 x 49.
1—Economy Baler—60 x 32 x 96, with 5 h.p. motor.

BEATER FILLING
1—New 54" Beater Filling with ⅜" bars, woods and bed plate.

BLOWERS
1—Sturtevant Monogram Fan, Ball bearing, Size 7.
1—Sturtevant Multivane Fan, Ball bearing, Size 6.

CALENDER ROLLS
16—Chilled Iron Rolls—Assorted sizes.

CALENDER STACKS
1—Farrel Birmingham, 5 roll, 108" Calender with doctors, 2 rolls bored for steam.
1—Black Clawson 90" 7 roll with 2 spare rolls.

"CYCLAFINER"
1—Shartle "Cyclafiner" with coupling.

CYLINDER MOLDS
1—134" face x 36" diameter, with stainless steel shafts.
1—77" face x 48" dia.—Stainless Steel Shaft.

DAMPENER
1—Valley Micromist Unit for water finish on paper—120" deckle.

DRIVES
1—#3 Reeves anti-friction bearing.
1—Beloit enclosed drive right angle, ratio 3 to 1, with couplings and pulleys.
1—Falk enclosed drive, 100 H.P., ratio 5 to 1.
1—Link-Belt 40 h.p., ratio 2.2-1, 500 r.p.m.—227 r.p.m.
1—Cleveland enclosed drive right angle, 7 h.p., 24½ to 1 ratio, 1750 r.p.m.
3—#2 Reeves enclosed vertical drives, ratio 3 to 1.

DRYERS
17—160" face x 48" diameter.
2—160" face x 36" diameter.
34—143" face x 48" diameter with frames, gears, bearings, steam joints, etc.
7—137" face x 48" diameter with frames, gears, bearings, steam joints, etc.
13—132" face x 48" diameter with frames, gears, bearings, steam joints, etc.
1—130" face x 48" diameter.
19—127" face x 42" diameter.
1—126" face x 48" diameter.
2—124" face x 48" diameter.
1—117" face x 48" diameter.
2—116" face x 48" diameter.
1—116" face x 36" diameter, with gears and bearings.
1—110" face x 42" diameter, with bearings.
1—104" face x 36" diameter.
2—103" face x 48" diameter.
1—102" face x 48" diameter, with bearings.
15—86" face x 36" diameter, with frames, gears and bearings.
19—88" face x 36" diameter, with frames, gears and bearings.
1—77" face x 48" diameter—with gear.
39—46" face x 48" diameter, with gears, bearings and steam joints.
3—42" face x 36" diameter, with frames, gears and bearings.

EXTRACTOR ROLLS
1—Downingtown Extractor Roll—128" face x 24" diameter. Anti-friction bearings.

FILTERS
1—Oliver Vacuum Filter, 10' face x 5' 3" diameter. Steel vat.

FLAT SCREENS
3—8 plate Sandy Hill Roller Shoe with scrapers.
3—Bagley & Sewall 8 plate, with scrapers and plates.

FOURDRINIER WIRES
3—New Lindsay 76" x 47 ft. 10"—60 mesh.

HYDRAULIC PRESS
1—Thorpe 200 ton. Steam platens, 40" x 40" with pump.

JORDANS
1—#6 Miami, for motor drive.
1—Jones Majestic Stainless Steel Filling.
2—E. D. Jones Pony, 3/16" stainless steel fillings—banded plugs, spare new fillings.
1—Smith & Winchester Standard with granite fillings.

KAMYR WET END
1—Kamyr Wet End. Cylinder 59" diameter x 80" face. Steel vat—rubber couches—spare rolls and spare parts.

KNIFE GRINDER
1—100" Hanchett Knife Grinder with motor.

LABORATORY EQUIPMENT
1—Watson Stillman Hydraulic Press 12" x 12" platens, 5½" daylight opening. Built in Pump.
1—New Sperry 12" Filter Press—20 plate.

LAMINATOR
1—Black-Clawson 48" Foil Laminator, complete, including Hamblet Sheeter. Used 1 month.

MOTORS
1—Allis Chalmers 30 h.p., 440 v., 660 r.p.m.
1—General Electric—25 h.p.—230 volts—3 ph—60 cycle—300/900 r.p.m.
25 other 440 v. motors from 2 h.p. to 15 h.p.
1—Electric Machine Company 200 h.p. synchronous—2200 V., 3 phase, 60 cycle, 1200 r.p.m. Direct connected to exciter and starter panel.

PULP EQUIPMENT
2—APMEW Ball Bearing Pulp Screens—30 ton capacity—outward flow.
1—D. J. Murray 10' x 25' Barking Drum.

PULPERS
2—#2 Lannoye.

PUMPS
1—New Worthington—bronze filled, 10,000 g.p.m., 35' head, with extended base for motor—spare new impeller.
44—Centrifugal Pumps, open & closed impellers. Direct connected or Belt Driven. Extended base for motor. Assorted capacities and heads. Most used less than one year.

REELS
1—Pusey & Jones 162" drum reel, complete with unwind stand and water cooled brake.
1—98" face x 24" diameter Drum Reel. Will rewind 40".

ROLL GRINDER
1—Lobdell 18' Roll Grinder handles 26" maximum diameter rolls.

ROLLS—PRESS, COUCH, etc.
32—Press rolls, brass and rubber covered.
14—Couch rolls, brass and rubber covered.
250—Brass and steel carrying rolls.

ROTARY SCREENS
2—#2 Bird—Copper vat.

SAVEALL
1—Bird #5 with enclosed drive and 3 h.p. motor.

SCREW PRESSES
1—Valley Voith Screw Press, size 2.
1—Valley Voith Screw Press—enclosed drive

SHEETERS
1—Hamblet 124" Duplex Sheeter with maxim layboy—8 roll backstand—motor and starter.
1—Moore & White Simplex 114" Sheeter with slitters—counter. Maxson layboy overlapping delivery. 8 roll backstand, motor and starter.
2—Finley 42", single knife.
1—Moore & White 42", single knife.

SHREDDERS
1—American 37" Hammermill, anti-friction bearing.
1—Jeffrey, 26½" knives, 7 knife rotor, 6 knife bed plate. Ball bearing.

SLICE
1—Beloit 132" adjustable slice, complete, including stands. Slice is of all bronze construction. Operated 1000 feet per minute.

SLITTERS AND WINDERS
1—Beloit 125" Paper Machine Slitter and Rewinder—42" rewind.
1—Cameron 44", Model 9-S.
1—Hudson Sharp 60" Wax Paper Automatic Slitter and Rewinder.

SMOOTHING PRESSES
2—New Farrel Birmingham 108" face x 24" diameter. Rubber covered, with ball bearings and enclosed drives.

STEAM TURBINES
1—De Laval 225 h.p. Initial pressure 140 p.s.i. Exhaust pressure 35 p.s.i. Complete with gear reducer.
1—De Laval Variable Speed—325 h.p. at 135 gauge and 30 p.s.i. exhaust. Complete with gear reducer.

STOCK PUMPS
1—Shartle 10 x 20 Single Plunger Pump.
2—Beloit 8 x 10 Triplex.
1—Triplex—8 x 10. Used less than 1 year.
2—Shartle Agi-flo, 13" suction, 14" and 4" discharge. Anti-friction bearings.
1—Beloit 10 x 20 Triplex.
1—Moore & White 10 x 16 Triplex.
1—Moore & White 8 x 8 Triplex.

SUCTION BOXES
6—Brass Suction Boxes, 156" x 4" opening.

SUCTION COUCH ROLLS
1—Millspaugh 36" diameter x 234" drilled face with enclosed drive, water cooled bearings, 12" suction boxes.
1—Millspaugh 156" drilled face x 22" diameter Suction Couch. Operated at 1000 ft. per minute.
1—Sandusky Suction Couch, 25" diameter x 122" drilled face.

SUCTION FELT ROLL
1—New Downingtown 186" drilled face x 16" diameter, with anti friction bearings and stands.

SUCTION PRESS ROLLS
1—Sandusky 84" drilled face x 22" diameter, rebuilt.
1—Sandusky Suction Press 22" diameter x 122" drilled face, with anti friction bearings and frames.

SUPERCALENDER STACK
1—Norwood 60" 10 roll, complete with motors and controls.

TOILET TISSUE PERFORATOR
1—Paper Converting Machine Co. Model 141 automatic 81" Perforator, Slitter and Winder—with three motors—ball bearing.

TRANSMISSION ROPE
700 ft.—New 1¼" Hemp Rope.
700 ft.—New 1¼" Cotton Rope.

TRIMMERS
1—Seybold 64"—20th Century.
1—Howard 44"—Downstroke type.

VACUUM PUMPS
2—Nash ½ H-5 Vacuum Pumps.

VOITH INLETS
2—Valley Iron Voith Inlets, adjustable 83" to 86"—brass lip, stainless steel apron.
1—Valley Iron Voith Inlet 156", with motor drive, brass construction. Operated at 1000 ft. per minute.
1—Valley Iron Voith Inlet — 108" — bronze construction.

VORTRAPS
9—4" Stainless Steel with rubber lined heads. 3" Hills McCanna Valves and stainless steel headers.

WRAPPING MACHINE
1—Morrow Stevens type 1C. Package thickness ¾" to 5". Used 30 days.

WET MACHINES
1—Rogers 72" double press Wet Machine, 48" diameter cylinder mold—with rubber couch.
1—Rogers 96" double press Wet Machine, 48" diameter cylinder—rubber couch, spare new top and bottom felts.

WHY LIST YOUR EQUIPMENT? — WE WILL BUY IT!

FOR SALE | **FOR SALE** | **FOR SALE**

For Sale—Immediate Delivery

One complete 90" trim 2-cylinder machine with two suction presses, one plain press, suction return drum roll, 61 dryers, two calender stacks, reel, slitter, and winder. Spiral bevel enclosed drives. Lineshaft and steam turbine, beaters, jordans, Claflin vacuum and stock pumps, and agitators. In fact, one complete machine with auxiliary equipment.

The Black-Clawson Company
Shartle Bros. Machine Division
Used Equipment Department
Middletown, Ohio

F-27

FOR SALE

BERWIN PAPER MFG. CO.
PLANT IN DANSVILLE, N. Y.

Two cylinder type machines, 73" and 64" trims. Complete plant newly remodeled in top condition, ready to go. Good inventory of stock, parts, felts, screens, etc. included. Brokers protected. Full details on request to:

Room 508, 55 Exchange St.
Rochester 14, N. Y.

M-13

FOR SALE

42" Camachine No. 6
48" Kidder model CH Slitter.
75" Moore & White Upright 2-drum Rewinder.
100" Dillon Sheeter, with Back-stand.
68" Oswego mill type Power Cutter.
Back-stands, made to order—any size.
THOMAS W. HALL COMPANY, Inc.
120 West 42nd St., New York 18
(Plant at Stamford, Conn.) TF

FOR SALE—New 6-plate Packer Screen, roller shoes, oak frame, cypress vat and flow box; never used; 6 new screen plates, .022 cut; drive motor belts and sheaves available. Address Box 53-52 care Paper Trade Journal. F-27

FOR SALE—USED Connersville Pump. Serial #8149, size 8 x 12, 815 RPM, 20" Mercury, 480 CFM, 30 HP motor required. This pump is in very good condition. Address Box 53-89 care Paper Trade Journal. M-6

FOR SALE—SPLITTER—Horizontal, pneumatic will handle wood 4'0" in length. New in '52. Never uncrated—immediately available. The Racquette River Paper Company, Potsdam, N. Y. TF

FOR SALE

1—36", 1—41" and 1—51" Sheeters. Machines sheet from 18" to 140".
1—Cameron #6, 42"; 1—Cameron #9, 45".
All these machines are in excellent condition and ready to operate.
NUPAKO, 1090 Myrtle Ave., Bklyn., 6, N.Y.
Tel.—GL—3-9550 M-20

FOR SALE

Complete Paper Mill including 91" Harper Yankee Machine, Coating and Mixing Equipment, Niagara Beaters, Dilts Hydrafiner, Monarch Jordon, 5 Roll Calender Stack. Ample storage and shipping space. Railroad siding, excellent water. In operating condition. Weights 10 to 30 pounds. Convenient to Eastern metropolitan markets.
Address Box 53-85 care Paper Trade Journal.
M-6

FOR SALE

1—#8 Nash Hytor Vacuum Pump, direct connected to 90 h.p. synchronous motor with starter.
1—#9 Nash Hytor Vacuum Pump, direct connected to 110 h.p. synchronous motor with starter.
1—#20 Taylor Stiles Rag Cutter, anti friction bearings.

J. J. ROSS COMPANY
250 Frelinghuysen Ave. Newark, 5, N. J.
Tel. Bigelow 3-3720 F-27

FOR SALE — 52" Cameron Slitters; 48" Knowlton Dble. Side Sheet Waxer; 38" F. & L. Coater; #6 Brightwood; Set-up & Folding Box Machines of all makes and sizes. Write for listings. Address Box 53-83 care Paper Trade Journal. TF

WANTED

WANTED—Heavy duty finishing room rewinder for rewinding paperboard .016 to .050 caliper, 76" to 82" wide. In reply state age, condition, number of slitters, type of power unit and price. Address Box 53-54 care Paper Trade Journal. F-27

WANTED—36" to 42" Sheeter (preferably Hamblet, but not essential), with or without Layboy. Please give all details, location, condition, full description, best Cash price, first letter. Address Box 53-63 care Paper Trade Journal. F-20

WANTED—Cameron Slitter—42" to 96". No dealers. Address Box 53-88 care Paper Trade Journal. F-27

WANTED—1 second hand machine required for the manufacture of dry cleaner bags, up to a maximum size of 25½" x 56½", complete with one or two color printer. Full particulars and price to Box 53-86 care Paper Trade Journal. M-13

BUSINESS OPPORTUNITY

"GOT SOMETHING NEW?"

Old Established Paper Mill Machinery Builder wants new ideas and new equipment. Modern plant facilities and highly skilled personnel available. Contact box 53-58 care Paper Trade Journal. F-27

GOVERNMENT BIDS

PROPOSALS

FOR FURNISHINGS

PAPER FOR THE U. S. GOVERNMENT PRINTING OFFICE

SEALED PROPOSALS will be received until 10 a. m., March 9, 1953, E. S. T., in the room of the Joint Committee on Printing, in the Capitol, Washington, D. C., for furnishing the paper for the public printing and binding, and blank paper for the use of the Government departments and establishments in the District of Columbia for the term of three months, beginning April 1, 1953; deliveries to be f. o. b. Government Printing Office Warehouse, or Warehouse Siding, Washington, D. C. The proposals will be opened in the presence of and the award of contracts made by the Joint Committee on Printing to the lowest and best bidders for the interest of the Government whose bids are in conformity with the requirements of the proposal. The Committee reserves the right to reject any or all bids, or to accept any bid or any part and reject the other part, if, in its opinion, such action would be in the interest of the Government.

Blank proposals containing the instructions, schedules, and specifications may be obtained by addressing John J. Deviny, Public Printer, Washington 25, D. C.

Contracts will be entered into for supplying the quantities required, whether more or less than the estimates, as provided in paragraph 15 of the instructions.

The approximate estimated quantities set forth in detail in the schedule comprise:

PAPER

1,540,000 pounds newsprint paper; 1,795,000 pounds machine-finish book paper; 20,000 pounds english-finish book paper; 40,000 pounds machine-finish look end paper; 5,410,000 pounds offset book paper; 225,000 pounds antique book paper; 290,000 pounds water-resistant (text) book paper; 890,000 pounds supercalendered book paper; 1,727,000 pounds coated book paper; 1,105,000 pounds mimeograph paper; 270,000 pounds duplicator copy paper; 7,545,000 pounds writing paper; 453,500 pounds map paper; 350,000 pounds manifold paper; 1,880,000 pounds bond paper; 610,000 pounds ledger paper; 1,045,000 pounds index paper; 285,000 pounds cover paper; 155,000 pounds manila paper; 260,000 pounds kraft paper; 300,600 sheets gummed paper; 20,000 pounds blotting paper; 5,000 pounds wallet board; 65,000 pounds tag board; 58,000 sheets railroad board; 135,000 pounds wood cardboard; 200,000 pounds tan board; 3,080,000 pounds postal card paper; 20,000 pounds folding bristol board; 47,000 sheets pressboard; 235,000 pounds newsboard; 325,000 {pounds binder's board. {pounds chestnut cover board.

By direction of the Joint Committee on Printing.
JOHN J. DEVINY,
Public Printer.

WASHINGTON, D. C.
February 24, 1953. F-27

CLEARING HOUSE ADS BRING GOOD RESULTS

WHERE TO BUY

Products listed in this section are those submitted by our advertisers.

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The Dow Chemical Co.
E. I. du Pont de Nemours & Co., Inc.
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ADJUSTABLE SHAKE MOTION
Downingtown Mfg. Co.
Manchester Machine Co.
Rice Barton Corporation

AGITATORS
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The Sandy Hill Iron & Brass Works
Valley Iron Works Co.
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The Moore & White Co.
Shartle Brothers Machine Co.
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BASIC WEIGHT SCALES
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Beloit Iron Works
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E. D. Jones & Sons Co.
Link Belt Co.
Magnus Metal Corp.
The Moore & White Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Timken Roller Bearing Co.
The Torrington Co.
Valley Iron Works Co.
Westinghouse Electric Corp.

BEATERS AND JORDANS
Apmew, Inc.
The Appleton Machine Co.
Black Clawson Company
Dilts Machine Works
Downingtown Mfg. Co.
Hermann Mfg. Co.
E. D. Jones & Sons Co.
Midwest Fulton Mch. Co.
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Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.

BED PLATES
Bahr Brothers Mfg. Co.
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
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Midwest Fulton Mch. Co.
Rice Barton Corporation
Shartle Brothers Machine Co.
Valley Iron Works Co.

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Alexander Bros. Belting Co.
Goodrich, B. F., Co.
The Goodyear Tire & Rubber Company
Link Belt Co.
Manheim Mfg. & Belting Co.

BINS, STORAGE
Biggs Boiler Works Co.

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Columbia-Southern Chem. Corp., Sub. of Pittsburgh Plate Glass Co.
E. I. du Pont de Nemours & Co., Inc.
General Dyestuff Corp.
Virginia Smelting Co.

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Improved Paper Machinery Corp.
Jackson & Church Co.
E. D. Jones & Sons Co.
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Railway Supply & Mfg. Co.

LINTER PULP
Hercules Powder Co., Inc.

LUBRICANTS
Cities Service Oil Co.
Gulf Oil Corp.
Sinclair Refining Co.
Socony-Vacuum Oil Co.
Sun Oil Company
The Texas Company
Tide Water Associated Oil Co.

MAGAZINE REELS
Dilts Machine Works (Kohler Systems)

MAGNETIC SEPARATORS
Bauer Bros. Co.
Eriez Manufacturing Co.

MATERIALS HANDLING
Dilts Machine Works
Downingtown Mfg. Co.
Ederer Engrg. Co.
Jeffrey Mfg. Co.
Link Belt Co.
Shartle Bros. Mch. Co.
Towmotor Corp.
The Wellman Engrg. Co.

MICROMETERS & CALIPERS
Farrel-Birmingham Co.
Lobdell Co.
Testing Machines, Inc.

MIXERS
Jackson & Church Co.
Mixing Equipment Co.

MICRO-CRYSTALLINE WAXES
Sun Oil Company

MOISTURE CONTENT CONTROL
Cambridge Instrument Co.
Testing Machines, Inc.
Williams Apparatus Co., Inc.

MOISTURE METERS
Testing Machines, Inc.

MOTORS
Elliott Company

MOTORS AND GENERATORS
General Electric Company
Reliance Electric & Engrg. Co.
Westinghouse Electric Corp.

NICKEL AND NICKEL ALLOYS
The International Nickel Co.

NOZZLES
Spray Engrg. Co.

PACKING BOXES
Johnson Corporation
The Moore & White Co.
Shartle Brothers Machine Co.

PADDLE SCREENS
Mundt, Chas., & Sons

PAPER MACHINE DRIVES
The Bagley & Sewall Company
Beloit Iron Works
Black-Clawson Co.
Downingtown Mfg. Co.
Manchester Machine Co.
Rice Barton Corporation
Westinghouse Electric Corp.

PAPER MACHINES
The Bagley & Sewall Company
Beloit Iron Works
Black-Clawson Company
Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
Thomas W. Hall Co.
Lukenweld
Manchester Machine Co.
Moore & White Co.
Pusey & Jones Corp.
Rice Barton Corporation
J. J. Ross Company
Ross Paper Machinery Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.

PAPER MACHINE SLICES
Black-Clawson Company
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
The Moore & White Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Valley Iron Works Co.

PAPER TUBE MACHINERY
Dietz Machine Works
Gibbs-Brower Company, Inc.
Thomas W. Hall Co.
Hudson Sharp Machine Co.
Langston Co., Samuel M.
Paper Converting Machine Co.

PARAFFINE WAXES
Sun Oil Company

PARAFFIN WAX EMULSIONS
American Cyanamid Co., Ind. Chem. Div.
Hercules Powder Co., Inc.
Nopco Chemical Co.

PASTING MACHINES
Beloit Iron Works
Black-Clawson Company
Dilts Machine Works
Frank W. Egan & Co.
Gibbs-Brower Company, Inc.
Murray, D. J., Mfg. Co.
Moore & White Co.
The Sandy Hil Iron & Brass Works
Shartle Brothers Machine Co.
Waldron Corp., John

PERFORATED SCREENS
Chas. Mundt & Sons

PEBBLE MILLS
F. L. Smidth & Co.

pH METERS
Cambridge Instrument Co.
Testing Machines, Inc.
Thwing-Albert Instrument Co.

PIPE
Armco Drainage & Metal Products, Inc.
Babcock & Wilcox Co.
Crane Company
Grinnell Company
National Tube Co.
Naylor Pipe Co.
Walworth Company

PIPE FABRICATORS
Pittsburgh Piping & Equipt. Co.

PIPE FITTINGS
Armco Drainage & Metal Products, Inc.
Crane Company
Grinnell Company
Pittsburgh Piping & Equipt. Co.
Walworth Co.

PIPING, HIGH PRESSURE
Pittsburgh Piping & Equipt. Co.

PITCH CONTROL
American Cyanamid Company, Industrial Chemicals Division
General Dyestuff Corp.
Monsanto Chemical Company
National Aluminate Corp.
Nopco Chemical Co.

PLASTICIZERS
American Cyanamid Company, Industrial Chemicals Company
Aktivin Division, Heyden Chemical Corp.
B. F. Goodrich Chemical Co.
Jackson & Church Co.
Naugatuck Chemical Division of U. S. Rubber Co.
Nopco Chemical Co.

PLATERS
Clark-Aiken Co.
Gibbs-Brower Company, Inc.
Perkins & Son, Inc., B. F.

PLATES
Armco Steel Corp.
Babcock & Wilcox Co.
Lukenweld Division
Lukens Steel Company
I. O. Ross Engrg. Corp.
Timken Roller Bearing Co.

PLUGS
The Appleton Machine Co.
Black-Clawson Company
E. D. Jones & Sons Co.
Shartle Brothers Machine Co.

POPE TYPE REELS
Black-Clawson Company
Downingtown Mfg. Co.
Egan, Frank W., & Co.
Manchester Machine Co.
Rice Barton Corporation

PRECISION SAMPLE CUTTER
Testing Machines, Inc.
Thwing-Albert Instrument Co.

PRESERVATIVES
Buckman Laboratories, Inc.
E. I. du Pont de Nemours & Co.
General Dyestuff Corp.

PRESS ROLLS
Beloit Iron Works
Black-Clawson Co.
Downingtown Mfg. Co.
Goodrich, B. F., Company, Inc.
Manchester Machine Co.
Rice Barton Corporation

PRESSURE FILTERS
Holyoke Machine Co.
Jackson & Church Co.

PRESSURE VESSELS
Biggs Boiler Works Co.
Chicago Bridge & Iron Co.
Combustion Engineering-Superheater, Inc.

PRESSES
Beloit Iron Works
Black-Clawson Company
Downingtown Mfg. Co.
Dietz Machine Works
Farrel-Birmingham Co.
Fibre Making Processes, Inc.
Gibbs-Brower Company, Inc.
Hudson-Sharp Machine Co.

Jackson & Church Co.
Manchester Machine Co.
The Moore & White Co.
Paper Converting Machine Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Testing Machines, Inc.
Valley Iron Works Co.
Waldron Corp., John
H. G. Weber & Co., Inc.
Williams Apparatus Co.

PROTECTIVE COATINGS
Insul-Mastic Corp. of America

PULLEY
Black-Clawson Co.
Dodge Mfg. Corp.
Rice Barton Corporation

PULP CLASSIFIER
The Bauer Bros. Co.
Testing Machines, Inc.
Thwing-Albert Instrument Co.

PULP CLEANERS
Bauer Bros. Co.
Bird Machine Co.
Nichols Engrg. & Research Corp.

PULP SCREENS
Bird Machine Co.
Mundt, Chas. & Sons

PULP STOCK VALVES
Crane Company
Grinnell Company
Record Fdy. & Mach. Co.
Rice Barton Research Corp.
Shartle Brothers Machine Co.

PULP WASHERS
Mundt, Chas., & Sons

PULPERS
Apmew, Inc.
Bauer Brothers Co.
Cowles Company
Dilts Machine Works
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Midwest Fulton Mch. Co.
Morden Machines Co.
Rice Barton Research Corp.
Shartle Brothers Machine Co.

PULPS
Brown Company
Bulkley, Dunton Pulp Co., Inc.
Gottesman & Co., Inc.
Lyddon & Co. (America), Inc.
Nordicus, Inc.
Parsons & Whittemore, Inc.
Perkins-Goodwin Co.
Price & Pierce, Ltd.
Pulp and Paper Trading Co.
Pulp Sales Corp.
Restigouche Co., Ltd.

PULPSTONES
Norton Company

PULP TESTERS
Testing Machines, Inc.
Williams Apparatus Co., Inc.

PULVERIZING MILLS
Jeffrey Mfg. Co.
F. L. Smidth & Co.

PUMPS
Apmew, Inc.
The Bagley & Sewall Company
Beloit Iron Works
Black Clawson Company
Buffalo Pumps, Inc.
Byron Jackson Co.
DeLaval Steam Turbine Co.
Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
Johnson Corp.
Moore & White Co.
Nash Engineering Co.
Roots Connersville Blower Corp.
J. J. Ross Company
Ross Paper Machy. Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.

RADIAL SCREENS
Chas. Mundt & Sons

RADIANT BURNERS
Red-Ray Mfg. Co., Inc.

RAG COOKING PROCESSES
General Dyestuff Corp.

RAG CUTTERS
Gibbs-Brower Company, Inc.
B. F. Perkins & Son, Inc.
Taylor-Stiles & Co.

RECOVERY SYSTEMS
Babcock & Wilcox Co.
Chicago Bridge & Iron Co.
Moore & White Co.
D. J. Murray Mfg. Co.
Peabody Engrg. Corp.
Pusey & Jones Corp.
Ross Engineering Corp., J. O.
Valley Iron Works Co.
Vulcan Copper & Supply Co.

REELS
The Appleton Machine Co.
The Bagley & Sewall Company
Beloit Iron Works
Black Clawson Company
Dilts Machine Works (Kohler Systems)
Egan, Frank W., & Co.
Downingtown Mfg. Co.
Hudson-Sharp Mch. Co.
Manchester Machine Co.
Moore & White Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
The Smith & Winchester Mfg. Co.
Waldron, John, Corp.

REFINERS
Appleton Machine Co.
Bahr Brothers Mfg. Co.
Bauer Brothers Co.
Dilts Machine Works
Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
Hermann Mfg. Co.
Jackson & Church Co.
E. D. Jones & Sons Co.
Morden Machines Co.
Murray, D. J., Mfg. Co.
Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Sutherland Refiner Corp.
Valley Iron Works

REGULATORS
Apmew, Inc.
Bird Machine Company
General Electric Co.
Improved Paper Machinery Corp.
Johnson Corp.
Shartle Brothers Machine Co.
Taylor Instrument Companies
Westinghouse Electric Corp.

RESINS
American Cyanamid Company, Plastics & Resins Division
Borden Company
The Dow Chemical Company
B. F. Goodrich Chemical Co.
The Goodyear Tire & Rubber Company
Hercules Powder Co.
Monsanto Chemical Company
Naugatuck Chemical Division of U. S. Rubber Co.
Nopco Chemical Co.
Reichhold Chemicals, Inc.

ROLLS
Appleton Machine Co.
The Bagley & Sewall Company
Beloit Iron Works
Black Clawson Company
Dilts Machine Works
Downingtown Mfg. Co.
Frank W. Egan & Co.
Farrel-Birmingham Co.
Gibbs-Brower Company, Inc.
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Holyoke Machine Co.
Lindsay Wire Weaving Co.
Lobdell United Co.
Manchester Machine Co.
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Rice Barton Corporation
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The Sandy Hill Iron & Brass Works
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Smith & Winchester Mfg. Co.
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Valley Iron Works Co.
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Wheeler Roll Co.

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Clark-Aiken Co.
Dilts Machine Works (Kohler Systems)
Frank W. Egan & Co.
Moore & White Co.
Potdevin Machine Co.
The Sandy Hill Iron & Brass Works
John Waldron Corp.
H. G. Weber & Co., Inc.

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Downingtown Mfg. Co.
The Moore & White Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works

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F. L. Smidth & Co.

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Chas. Mundt & Sons

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The Moore & White Co.
Rice Barton Corporation
Shartle Bros. Mch. Co.

RUBBER LINING
B. F. Goodrich Co.

RUBBER PRODUCTS
The Goodyear Tire & Rubber Company

SATURANTS
B. F. Goodrich Chemical Co.

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Gibbs-Brower Company, Inc.
Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Waldron Corp., John
Weber, Herman G.

SAVEALLS
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Chicago Bridge & Iron Co.
Improved Paper Machinery Corp.

SAWS
Simonds Saw & Steel Co.

SCALES
Merrick Scale Mfg. Co.
Testing Machines, Inc.

SCREEN PLATES
Bird Machine Company
Fitchburg Screen Plate Co.
Magnus Metal Corp.
Morey Paper Mill Supply Co.
Mundt, Chas. & Sons
Testing Machines, Inc.

SCREENS
Appleton Wire Works
Appleton Machine Company
The Bagley & Sewall Company
Bird Machine Company
Carthage Machine Co.
Dilts Machine Works, Inc.
Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
E. D. Jones & Sons Co.
Moore & White Co.
Mundt, Chas. & Sons
D. J. Murray Mfg. Co.
J. J. Ross Company
Ross Paper Machy. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Trimbey Machine Works
Valley Iron Works Co.

SCREENS, CHIP (Vibrating)
Link Belt Co.

SCREENS (Perforated)
Mundt, Chas., & Sons

SCREENS (Rotary)
Mundt, Chas., & Sons

SHAKES
Downingtown Mfg. Co.

SHAKE STICKS
Westinghouse Electric Corp.

SHEET MACHINES
Gibbs-Brower Company, Inc.
Downingtown Mfg. Co.
Thomas W. Hall Co.
Hermann Mfg. Co.
Testing Machines, Inc.
Valley Iron Works Co.
Williams Apparatus Co., Inc.

SHEET MACHINES—LABORATORY
Testing Machines, Inc.

SHOWER PIPES
Bird Machine Company
Black-Clawson Company
Downingtown Mfg. Co.
Moore & White Co.
Sandusky Fdy. & Mch. Co.
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.

SHREDDERS
Bauer Brothers Co.
Carthage Machine Co.
Gibbs-Brower Company, Inc.
Jackson & Church Co.
Jeffrey Mfg. Co.

SIZE PRESSES
Black-Clawson Co.
Downingtown Mfg. Co.
Manchester Machine Co.
Rice Barton Corporation

SIZING
American Bitumuls & Asphalt Co.
American Cyanamid Company, Industrial Chemicals Division
The Dow Chemical Company
du Pont, E. I., de Nemours & Co.
Glidden Company
Hercules Powder Co.
The Hubinger Co.
Monsanto Chemical Company
National Aluminate Corp.
Nopco Chemical Co.
Wyandotte Chemicals Corp., Michigan Alkali Div.

SIZING TESTER
W. & L. E. Gurley
Testing Machines, Inc.
Thwing-Albert Instrument Co.
Williams Apparatus Co., Inc.

SLIME CONTROL
Buckman Laboratories, Inc.
The Dow Chemical Company
E. I. du Pont de Nemours & Co.
General Dyestuff Corp.
Magnuson Products Corp.
Monsanto Chemical Co.
National Aluminate Corp.
Vanderbilt Co., R. T.
Wyandotte Chemicals Corp., Michigan Alakli Div.

SLITTERS
The Bagley & Sewall Company
Black-Clawson Company
Cameron Machine Co.
Carthage Machine Co.
Clark-Aiken Co.
Dietz Machine Works
Dilts Machine Works
Downingtown Mfg. Co.
Frank W. Egan & Co.
Gibbs-Brower Company, Inc.
Thomas W. Hall Co., Inc.
Hamblet Machine Co.
Hudson-Sharp Mch. Co.
Improved Machinery Inc.
Langston Co., Samuel M.
Moore & White Co.
D. J. Murray Mfg. Co.
Paper Converting Machine Co.
Rice Barton Corporation
J. J. Ross Company
Ross Paper Machy. Co.
The Sandy Hill Iron & Brass Works
Smith & Winchester Mfg. Co.
Valley Iron Works Co.
Waldron Corp., John

SMOKE STACKS
Chicago Bridge & Iron Co.

SOFTNESS-STIFFNESS TESTER
W. & L. E. Gurley
Testing Machines, Inc.
Thwing-Albert Instrument Co.

SOLUBLE OILS
American Cyanamid Company, Industrial Chemicals Division
General Dyestuffs Corp.
Nopco Chemical Co.

SPECIAL MACHINERY
Biggs Boiler Works Co.
Dilts Machine Works
Downingtown Mfg. Co.
Egan, Frank W., & Co.
Jackson & Church Co.
Manchester Machine Co.
Paper Converting Machine Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Waldron, John, Corp.

SPEED REDUCERS
Dodge Manufacturing Corp.
Downingtown Mfg. Co.
Link Belt Co.
Westinghouse Elec. Corp.

SPLICING TISSUE
Williams-Gray Co.

STAINLESS STEEL
Armco Steel Corp.
U. S. Steel Corp.

STARCH
Clinton Foods, Inc.
Corn Products Sales Co.
The Hubinger Co.
National Starch Products, Inc.

STEAM JOINTS
The Moore & White Co.
Rice Barton Corporation
Shartle Brothers Machine Co.

STEAM SPECIALTIES
Babcock & Wilcox Co.
Johnson Corp.

STEEL
Armco Steel Corp.
Carnegie Illinois Steel Co.
Lukens Steel Company
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works
U. S. Steel Corp.

STEEL, CLAD
Babcock & Wilcox Co.
Lukens Steel Company

STEEL TANKS
Chicago Bridge & Iron Co.
Jackson & Church Co.
The Sandy Hill Iron & Brass Works

STOKERS
Westinghouse Elec. Corp.

STRAINER SCREENS
Mundt, Chas., & Sons

STRETCH TESTER
Testing Machines, Inc.
Thwing-Albert Instrument Co.

STUFF CHESTS
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Moore & White Co.
Rice Barton Corporation
Shartle Brothers Machine Co.
Valley Iron Works Co.

SUCTION BOX COVERS
Appleton Wood Products
Westinghouse Electric Corp.

SUCTION BOX TOPS
Mundt, Chas., & Sons

SUCTION BOXES
Beloit Iron Works
Black-Clawson Company
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Manchester Machine Co.
Moore & White Co.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

SUCTION ROLLS
Beloit Iron Works
Downingtown Mfg. Co.
Manchester Machine Co.

SULPHUR
Texas Gulf Sulphur Co.

SULPHUR BURNERS
Valley Iron Works Co.

SULPHUR DIOXIDE
American Cyanamid Company, Calco Chemical Div.
Virginia Smelting Co.

SUPERCALENDERS
The Appleton Machine Co.
Clark-Aiken Co.
B. F. Perkins & Son, Inc.

SWITCHGEAR
Westinghouse Elec. Corp.

SYNTHETIC LATICES
American Cyanamid Company, Industrial Chemicals Division
B. F. Goodrich Chemical Co.
The Goodyear Tire & Rubber Company
Naugatuck Chemical Division of U. S. Rubber Co.
Nopco Chemical Co.

SYNTHETIC RESINS
American Cyanamid Co., Ind. Chem. Div.
Hercules Powder Co., Inc.

SYPHONS
Cram & Associates

TAILING SCREENS
Mundt, Chas., & Sons

TAKE OFF UNITS
Dilts Machine Works (Kohler Systems)

TALC
American Cyanamid Company, Industrial Chemicals Division
Vanderbilt Co., R. T.

TANKS
Chicago Bridge & Iron Co.
Kalamazoo Tank & Silo Co.
B. F. Perkins & Sons, Inc.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Stebbins Engrg. Co.

TEARING TESTERS
Thwing-Albert Instrument Co.
Testing Machines, Inc.

TENSILE TESTERS
Thwing-Albert Instrument Co.
B. F. Perkins & Son, Inc.
Scott Testers, Inc.
Testing Machines, Inc.
A. van der Korput

THICKENERS, DECKERS AND SAVEALLS
The Appleton Machine Co.
Bird Machine Company
Carthage Machine Co.
Chicago Bridge & Iron Co.
Dilts Machine Works
Downingtown Mfg. Co.
Improved Machinery Inc.
Moore & White Co.
D. J. Murray Mfg. Co.
Ross Paper Machinery Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works Co.

THICKENER SCREENS
Mundt, Chas., & Sons

TIRES
Stroh Process Steel Co.

TITANIUM
American Cyanamid Co., Calco Chemical Div.
E. I. du Pont de Nemours & Co.
Titanium Pigment Co.
R. T. Vanderbilt Co.

TOOLS
Walworth Company

TRACTORS AND TRUCKS
Elwell Parker Elec. Co.

TRANSFORMERS
Westinghouse Elec. Corp.

TRANSMISSIONS
Dodge Mfg. Corp.
Jeffrey Mfg. Co.
Link Belt Co.

TRAPS
Crane Co.
Grinnell Company
Johnson Corporation
Shartle Brothers Machine Co.

TUBE MILLS
F. L. Smidth & Co.

TUBES
Babcock & Wilcox Co.
National Tube Co.

TUBING MACHINES
Dilts Machine Works

TUBING, MECHANICAL
National Tube Co.

TUBS
Shartle Brothers Machine Co.
Valley Iron Works Co.

TURBINES
De Laval Turbine Co.
General Electric Company
Westinghouse Electric Corp.

UNWINDERS
Clark-Aiken Co.
Dilts Machine Works (Kohler Systems)
Downingtown Mfg. Co.
Egan, Frank W., & Co.
Rice Barton Corporation
Waldron, John, Corp.

USED EQUIPMENT
Gibbs-Brower Co.
Thomas W. Hall Co.
J. J. Ross Company
Ross Paper Machinery Co.
Shartle Brothers Machine Co.

V-BELTS
Dodge Mfg. Corp.
Goodrich, B. F., Company, Inc.

VALVES
The Bagley & Sewall Company
Crane Company
DeZurik Shower Co.
Dilts Machine Works
Downingtown Mfg. Co.
Grinnell Company
E. D. Jones & Sons Co.
Magnus Metal Corp.
D. J. Murray Mfg. Co.
William Powell Co.
Record Fdy. & Mch. Co.
Rice Barton Research Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works Co.
Walworth Company

VAPOR BARRIER COATINGS
Insul-Mastic Corp. of America

VATS
Biggs Boiler Works Co.
Black-Clawson Co.
Beloit Iron Works
Downingtown Mfg. Co.
Rice Barton Corporation

WASHERS
The Bagley & Sewall Company
Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
Improved Paper Machinery Corp.
Jackson & Church Co.
E. D. Jones & Sons Co.
Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works Co.

WASTE CONVEYOR SCREENS
Mundt, Chas., & Sons

WASTE TREATING EQUIPMENT
Hungerford & Terry, Inc.
Jeffrey Mfg. Co.
Link Belt Co.

WATER CONDITIONING
Calgon, Inc.
General Dyestuff Corp.
Hungerford & Terry, Inc.
National Aluminate Corp.
The Sandy Hill Iron & Brass Works

WATER DISPERSIONS
American Cyanamid Company Industrial Chemicals Division
Naugatuck Chemical Division of U. S. Rubber Co.

WATER FILTERS
Bird Machine Co.
Holyoke Machine Co.
Improved Paper Machinery Corp.

WATER PENETRATION TESTER
Testing Machines, Inc.
Thwing-Albert Instrument Co.
Williams Apparatus Co., Inc.

WATER SOFTENERS
Hungerford & Terry, Inc.
Wyandotte Chemicals Corp. Michigan Alkali Div.

WATER VAPOR CUPS
Testing Machines, Inc.
Thwing-Albert Instrument Co.

WAXING MACHINERY
Black-Clawson Company
Dilts Machine Works
Frank W. Egan & Co.
Gibbs-Brower Company, Inc.
The Mayer Machine Co.
Paper Converting Machine Co.
Potdevin Machine Co.
Shartle Brothers Machine Co.
Waldron Corp., John
Weber, Herman G.

WEB TENSION CONTROL
Dilts Machine Works (Kohler Systems)
Egan, Frank W., & Co.
Waldron, John, Corp.

WELDING EQUIPMENT
General Electric Company
Walworth Company
Westinghouse Electric Corp.

WELDING FITTINGS
Pittsburgh Piping & Equipt. Co.

WET MACHINES
The Bagley & Sewall Company
Black-Clawson Company
Carthage Machine Co.
Downingtown Mfg. Co.
Improved Paper Machinery Corp.
Moore & White Co.
Pusey & Jones Corp.
Rice Barton Corporation
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.

WET STRENGTHENING AGENTS
American Cyanamid Company Industrial Chemicals Division
Hercules Powder Co., Inc.
Reichhold Chemicals, Inc.

WETTING AGENTS
American Cyanamid Company Industrial Chemicals Division
Diamond Alkali Co.
General Dyestuff Corp.
Monsanto Chemical Company
Nopco Chemical Co.
Wyandotte Chemicals Corp. Michigan Alkali Div.

WHITE WATER TREATING EQUIPT.
Bird Machine Co.
Hungerford & Terry, Inc.
The Sandy Hill Iron & Brass Works

WINDERS & REWINDERS
The Appleton Machine Co.
The Bagley & Sewall Company
Beloit Iron Works
Black Clawson Company
Cameron Machine Co.
Clark-Aiken Co.
Dietz Machine Works
Dilts Machine Works (Kohler Systems)
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Frank W. Egan & Co.
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Manchester Machine Co.
Moore & White Co.
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Potdevin Machine Co.
Pusey & Jones Corp.
Rice Barton Corporation
Ross Paper Machinery Co.
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Smith & Winchester Mfg. Co.
Waldron, John, Corp.

WINDING ROLL CHANGERS
Dilts Machine Works (Kohler Systems)
Egan, Frank W., & Co.
Waldron, John, Corp.

WIRE BRUSHES
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Williams-Gray Co.

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Black-Clawson Company
Gilbert & Nash

WIRES
Appleton Wire Works
International Wire Works
Lindsay Wire Weaving Co.
Williams-Gray Co.
Wisconsin Wire Works

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CAST STEEL OR CRANE 18-8Mo ALLOY
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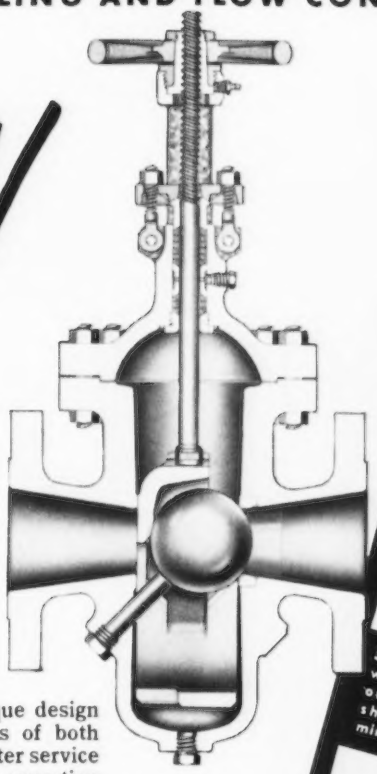

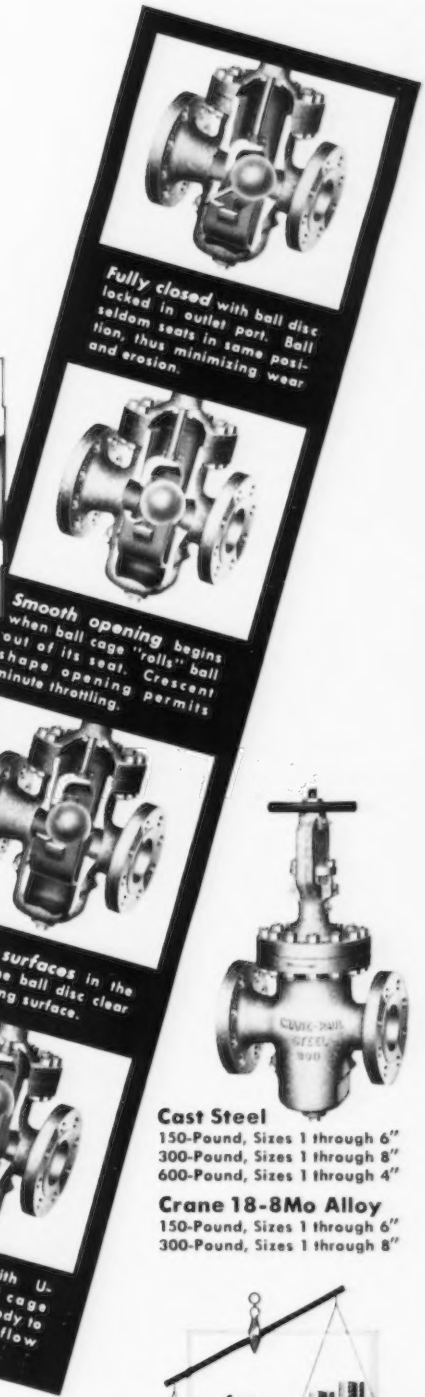
Fully closed with ball disc locked in outlet port. Ball seldom seats in same position, thus minimizing wear and erosion.
Smooth opening begins when ball cage "rolls" ball out of its seat. Crescent shape opening permits minute throttling.
Inclined surfaces in the cage lift the ball disc clear of the seating surface.
Fully opened with U-shaped bottom of cage bridging the gap in body to form a continuous flow passage.

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Exceptionally accurate throttling with a minimum of wear and erosion, resulting in long-lived seating surfaces.

Straight-through, non-turbulent flow—with pressure drop characteristics approaching those of venturi-type gate valves.

Smooth, easy response throughout the entire range of operation.

Completely tight shut-off.

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Literature Sent on Request

Full information on this new Crane-Paul Valve is in your Crane 53 Catalog. Literature is available from your Crane Representative or on request to address below.

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Crane 18-8Mo Alloy
150-Pound, Sizes 1 through 6"
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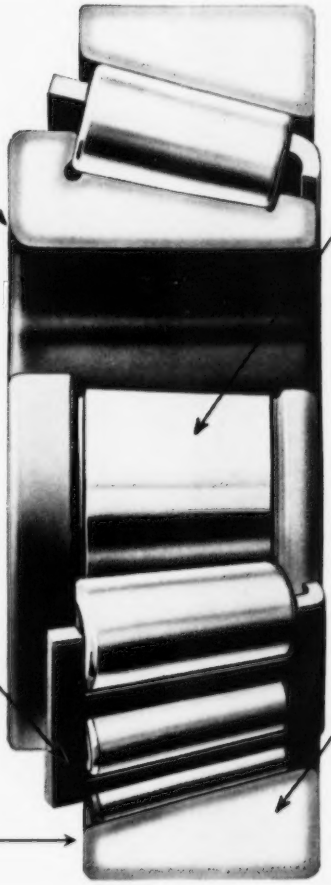

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